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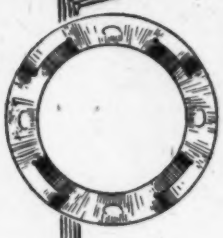

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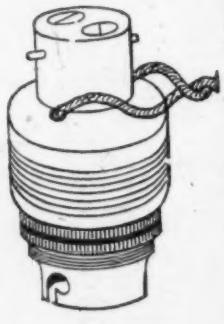

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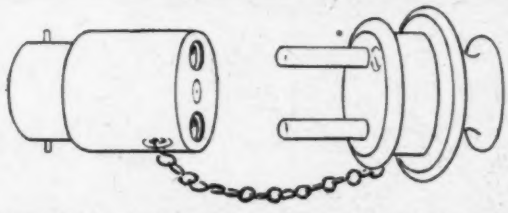

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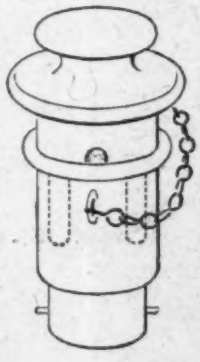

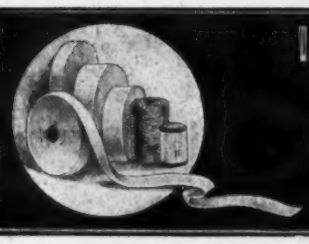

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ELECTRICAL REVIEW.

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THE ELECTRICITY SUPPLY BILL.

ONCE more the Government is making an effort to enact the supplementary provisions without which the Act of 1919 must necessarily remain to some extent a dead letter. Each Bill that is brought forward is shorn of some of the clauses to which strong opposition was raised in the case of its predecessor, and in introducing the latest version, Viscount Peel expressed the view of the Electricity Commissioners that no controversial elements remained in it. This may prove to be an unduly optimistic impression; opposition may be forthcoming from new directions—but certainly it appears that the clauses which were most bitterly resented in the earlier editions are now conspicuously absent, and consequently the Bill has lost its contentious character.

With the exception of this important change, and a number of verbal alterations, most of the original clauses are reproduced, but there are some important additions to the Bill. It is provided by Section 5 (4) that "a scheme constituting a Joint Electricity Authority may include provisions authorising or requiring authorised undertakers, and authorising companies and other bodies represented on the Authority, to contribute towards any administrative expenses of the Authority, and . . . requiring such authorised undertakers to meet any temporary deficiencies in the fund" which represents the Authority's working capital. This is an amplification of part of the old Section 13 (1), in a stronger form. Section 6 (2) enables the Electricity Commissioners to make the *pro rata* demand for contributions to their expenses upon the Joint Electricity Authorities and authorised undertakers of Great Britain (Ireland is now excluded from the operation of the Bill) during the current financial year instead of the next year after the passing of the Bill; and Section 6 (4) and (5) provides for revision of the above apportionments and the payment of interest on arrears, while Sub-section (7) makes them recoverable as a civil debt.

Section 8 enables a Joint Electricity Authority, by agreement, to use main transmission lines belonging to other persons besides authorised undertakers. Section 8 of the old Bill, empowering the Commissioners to require authorised undertakers to give reasonable facilities for supply within their area, and in default to order the transfer of the undertakings to the Joint Electricity Authority or to authorise the latter to undertake the supply, is omitted, and with it goes Section 13 (2), which purported to ensure that the benefit of any reduction in the cost of electricity to the undertakers or in the capital employed by them, due to the Act of 1919 or the amending Bill, should "enure to consumers"; burdened with these provisions, the Bill would never have become an Act, and we think the Government has done wisely in abandoning them.

Section 14 is devoted to the methods of charging and revision of prices, and contains new clauses of the utmost importance. Sub-section (1) repeals a provision in the Electric Lighting (Clauses) Act, 1899, and thus abolishes the obligation to provide a tariff based solely on the actual amount of energy supplied which has so long oppressed the industry. In this valuable concession we see the first-fruits of the deputation to the Government which was organised by the Electrical Development Association towards the end of 1920; if the sub-section is passed, it will be possible to adopt the multi-part tariff, the rateable-value, or any other system *approved by the Electricity Commissioners*, without stultifying it by the compulsory offer of a flat rate. It is to this clause that opposition may be raised by some

who fancy that they act in the interests of the consumer, and possibly by the gas interests, but we believe that the fact that the Commissioners will exercise control over the proposed tariff system will be accepted as an adequate safeguard. Other sub-sections provide for the revision of charges at intervals of three years.

Section 15 is entirely omitted. This related to the terms of payment for stations, &c., acquired by the Minister of Transport under Section 18 of the Act of 1919, and to the prices to be charged for electricity.

Section 15 of the new Bill extends the definition of "premises having a separate supply" to cover those having a "supply of gas, steam, or other form of energy applicable for the purposes for which electricity is demanded or received." This is a valuable improvement, ensuring that in future consumers of other "forms of energy" shall not be entitled to make a convenience of electricity as a mere stand-by without paying a fair price for the privilege. A new clause in Section 16 (1) restricts the power of the owner of a station generating electricity for traction to supply energy to an authorised distributor within the area of a power company without the consent of the latter; it is not clear, however, that a consumer within the area could not be supplied without the consent of the power company, and this is an important point which ought to be rectified. It is emphasised by another new clause which prohibits supply "to *any premises* within the district of a Joint Electricity Authority" without the consent of that authority. The whole question of the right of a railway company to supply electricity needs thrashing out, especially with reference to the London area.

Indications are not wanting that the passage of the Bill will be strenuously resisted, both in Parliament and in the financial Press, and the latter has already persuaded itself that the Joint Electricity Authorities will plunge into expenditure on a colossal scale—one estimate reaching 110 millions sterling!

But there are two considerations to which we attach great weight. One is that the Electricity Commissioners will have control over the Authorities, and we have confidence in their judgment; the other is that expenditure is absolutely necessary, and that if it is not controlled and co-ordinated, the aggregate outlay will be vastly greater. Hence we trust that the Bill will pass, and we believe that its effect will be beneficial to the electricity supply industry and to the nation.

Overseas Trade Development.

Our readers will recall that we have consistently urged the need for a strong State department charged with the duty of watching and furthering the interests of British commerce overseas. We have observed with grave concern the endeavours that have been made since the Armistice to reduce the fighting strength of the Overseas Trade Department which was organised and developed during the war. The Department was then placed on a much sounder basis than the old Commercial Branch of the Board of Trade, with the express view of preparing for the post-war renewal of British export trade.

In our opinion the attempts that have been made from time to time recently to effect petty economies in the Department have shown ignorance both of the proper policy of Governmental assistance in overseas trade and also of the actual work of the Department, whilst the latest attempt on the part of the Geddes Committee to stifle its activities has shown an entire misinterpretation of the needs of the commercial community. We will not again contrast the Geddes recommendation practically to abolish the Department of Overseas Trade with the action of other exporting countries in expanding similar organisations. But whilst we recognise how essential it is that Government expenditure be reduced and taxation decreased in this country, we refuse to believe that any real economy would be effected by curtailing any sound measures to promote the export of British manufactures. We therefore welcome the announcement made by Sir R. Horne that "the Government think it would be a great misfortune to do away with the instrument which the traders of this country and those who trade with them beyond the seas regard as a most useful link in the conduct of their operations." We are glad to learn further from Sir R. Horne's remarks that the opinions which we have always expressed in these columns on behalf of the electrical and allied industries are endorsed by business men generally. The Department should be strengthened, not weakened. If its senior officials keep in close touch with the export merchant and manufacturer and show themselves capable of anticipating and administering to the requirements of both, the Department should have no difficulty in yielding a full return to the taxpayer for its annual cost.

Diversity of Interests.

At the last meeting of the National Industrial Council (Electric Supply) a veto was placed on the proposed "Conference of Joint Industrial Councils and other Bodies in the Electrical Industry." It was resolved by the National Council that it was not in favour of setting up a permanent body of this kind, to which some of the constituent Associations very strongly objected. The purpose of the Conference was to represent the needs of the industry to Government Departments, issue to the Press authoritative statements on matters affecting the industry, and so forth. The Conference was to comprise three Industrial Councils (Electric Supply, Cable Making, and Electrical Contracting), and the B.E.A.M.A., the Electrical Wholesalers' Federation, and the B.E.D.A. The constitution of this body was obviously of a somewhat hybrid nature, and it was felt that the electricity supply industry would be giving very important delegated powers and have a very fractional and indirect voice in the doings of the Conference. This was outside the question whether the National Council, which was obviously an *ad hoc* body exclusively for labour matters, would not be acting *ultra vires* in appointing members to a standing conference which dealt with matters entirely outside the range of the Councils. Anyhow, so far as the electricity supply industry is concerned, the new Conference will have to exclude this particular Industrial Council, and if it goes on with the scheme, it will simply represent the manufacturing and contracting industries.

The question at issue was, of course, not merely one of meeting and conferring with other bodies, but one of setting up a new substantive and independent body which would have full executive powers and, moreover, would appear to be, in some sense, an overhead and final authority to which the other Councils and Associations would be subordinate.

Hydraulic Storage.

The successful achievement of the Walkerburn hydro-electric scheme, which is described elsewhere in this issue, is interesting in view of the proposal to adopt hydraulic storage on a colossal scale in connection with the Severn tidal power scheme. We believe that very few installations of this type are in existence. The idea, however, is old, and we well remember the proposal of Mr. H. Wilson Fox, manager of the British South African Co., in 1905, to adopt it on the Rand. The promoters proposed to generate 250,000 h.p. at the Victoria Falls on the River Zambesi, and to transmit power a distance of 700 miles to the Rand. At the time, Mr. W. B. Esson estimated that the cost of aluminium cables to transmit 15,000 kW to the mines at 100,000 volts would be well over a million pounds.*

To obtain a load factor of 100 per cent. at the generating station, it was proposed to pump water up to an elevated reservoir at the delivery end of the line, and to generate electricity with it at times of heavy load. The scheme was never carried out, because it was found far better to generate with steam power in the neighbourhood of the mines, but on technical grounds it was of great interest.

* Electrical Review, December 15th, 1905, p. 957.

THE MECHANICAL STORAGE OF WATER POWER.

WALKERBURN HYDRO-ELECTRIC SCHEME.

A water-power installation which possesses many novel features has lately been put into operation, and is now supplying power for driving the Tweedvale and Tweedholm Mills at Walkerburn, Peebleshire. This village became a thriving community when these two mills were established in 1854; the mills owed their existence to

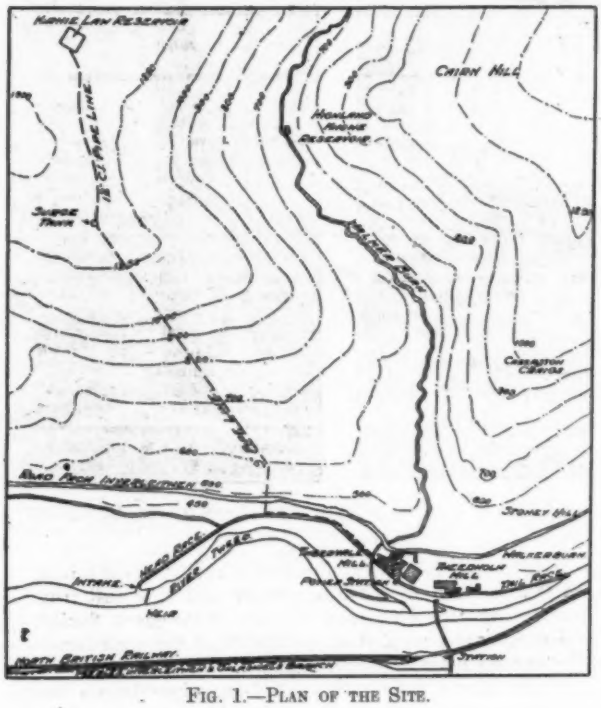


Fig. 1.—Plan of the Site.

the water power which was available in the Tweed, and for a long time this was the only power used in them.

The fall available was divided between the two mills, the water leaving the wheels of the upper mill and passing through the wheels of the lower mill before returning to the river. The falls utilised were respectively 5 ft. 3 in. and 5 ft., for, although the total head between the intake and the point of return to the river was 15 ft., nearly 5 ft. was lost in the long head and tail-races. The mills, which covered a considerable area, had long grown beyond the power available from the old breast wheels, which together yielded only about 110 h.p., and other means of driving had from time to time been added to supplement this water power. A great loss of power in transmission to the scattered buildings by means of long lines of shafting and bevel gearing was unavoidable.

Full development of the water power was impossible until the ownership of the rights for the whole of the fall passed into the hands of one owner. Messrs. Henry Ballantyne & Sons, Ltd., owners of the Tweedvale mills, purchased the Tweedholm mills in July, 1918. They decided to utilise the water available to the best advantage, and to eliminate the heavy transmission losses by introducing electrical drive. Messrs. Boving and Co. (London), Ltd., were asked to prepare a suitable scheme, and their proposals were adopted.

The first point decided was that the head available should be developed in one place. The obvious advantages of this are that an economical head is available for driving the turbines, and that the duplication of plant and operating staffs is avoided. It was decided to concentrate the fall at the upper mill by deepening the race between the two mills, as it was impossible to concentrate it at the lower mill in view of the flooding of intermediate buildings which would have occurred. This involved a considerable amount of excavation. The head anticipated was 10 ft. 6 in., but further improvements in the hydraulic conditions have been made and the operating head is now, under normal conditions, slightly over 11 ft.

The power available under these conditions was 220 h.p., exactly double that given by the old breast wheels. A survey of the power requirements of the two mills showed that a total of 450 h.p. was needed, and the problem was then to find the balance, *i.e.*, 230 h.p.

The mills work for about 50 hours per week, so that for two-thirds of the week the power available would not have been used. With the low head of 10 ft. 6 in. the storage of the water was quite impossible. Electrical storage of the surplus power was also deemed impracticable, and it was finally decided to store the power mechanically under the following plan. During the idle hours the turbines were to be run for the purpose of driving pumps. The water from these was to be delivered to a high-level reservoir and stored therein. During the working hours the water would run down from the high-level reservoir through the same pipe as it flowed up through before, and by driving a Pelton wheel would generate the extra power required.

A survey of the conditions proved this to be quite feasible, for the hills immediately behind the mills rose up steeply to a height of over 1,000 ft., offering an ideal site for the reservoir in contemplation. Fig. 1 shows the general plan of the site; the two mills standing on the mill lade close to the bank of the Tweed are clearly shown, as are the positions of the reservoir, the 12-in. cast-iron pipe-line, surge tank, and 9-in. steel-riveted pipe-line. The high-pressure pipe-line, to save expense, was brought as steeply as possible down the hillside. The reservoir had to be placed on a saddle some little distance away, and was connected to the top of the high-pressure pipe-line by a 12-in. cast-iron pipe running practically on the level round the contour of the hill. A surge tank is necessary at the junction point

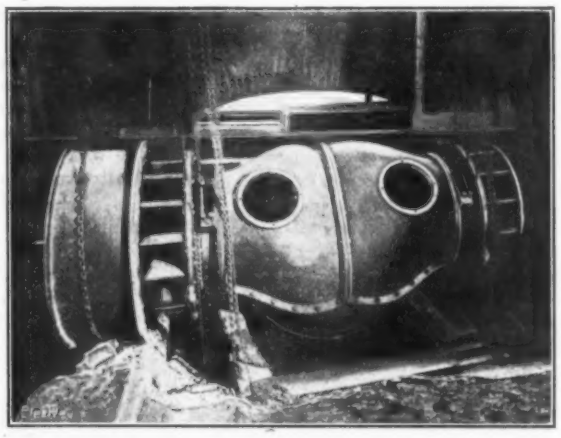


Fig. 2.—Low-pressure Turbine in Course of Erection.

to provide or absorb water at times of change of load, for the 9-in. pipe being on a steeper slope will more readily accommodate itself to changes of load, and on increasing loads will draw off more water than the 12-in. pipe can immediately supply.

This scheme provides the extra 230 h.p. required, for in spite of the fact that a good deal of the energy available during the idle hours is absorbed in the pumps, in pipe friction, and in losses in the Pelton wheel, the idle time being longer than the working time fully compensates for this and enables the effective power to be more than doubled.

The low-pressure turbines consist of two large double-runner, horizontal Francis turbines of 110 h.p. each, running at a speed of 200 r.p.m. Between these turbines is a water-tight chamber.

D

Each turbine is furnished with a large faced belt-pulley of double width, the diameter being 100 in. The outlets from the turbines are inclined at an angle to reduce the amount of disturbance to existing buildings, and also to give a cleaner exit for the water. Both these low-pressure turbines drive a single generator of 145 kW running at 600 r.p.m., each end of the generator shaft having an overhung crowned pulley for the purpose.

similar to those on this generator. These shafts drive the high-pressure pumps creating the head of 1,050 ft. which is required. During the idle hours the belts are changed over from the generator pulleys to the pump pulleys.

Since the quantity of water delivered by each pump is relatively small, namely, 220 gallons per minute, it would have been quite impracticable to run at a speed of 600 r.p.m., and therefore a gear-drive had to be re-

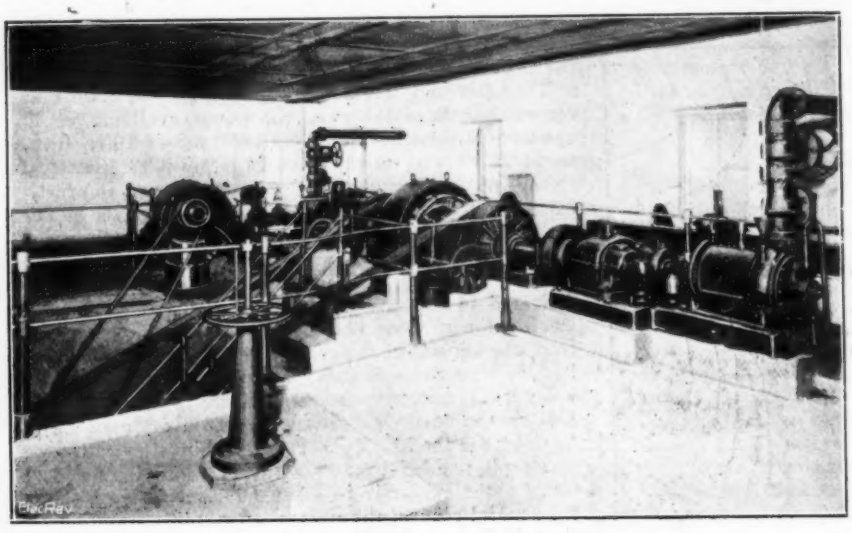


Fig. 3.—Generating and Pumping Plant.

Fig. 4.—Wall of Reservoir.

Under normal operations the low-pressure turbines are run on hand control. During the day all variations of demand are met by the high-pressure turbine. Thus the low-pressure turbines run on full load, and only the balance of power is drawn from the reservoir. At night, since the pumping load is constant, hand control suffices.

sorted to, and the pumps themselves run at 3,000 r.p.m. To isolate the gear-case and prevent any side pull from interfering with the correct meshing of the gears, flexible couplings are provided on each side of the gear-boxes The arrangement is shown in fig. 9.

These pumps deliver through 4-in. pipes into a bus pipe connected both to the 9-in. high-pressure pipe

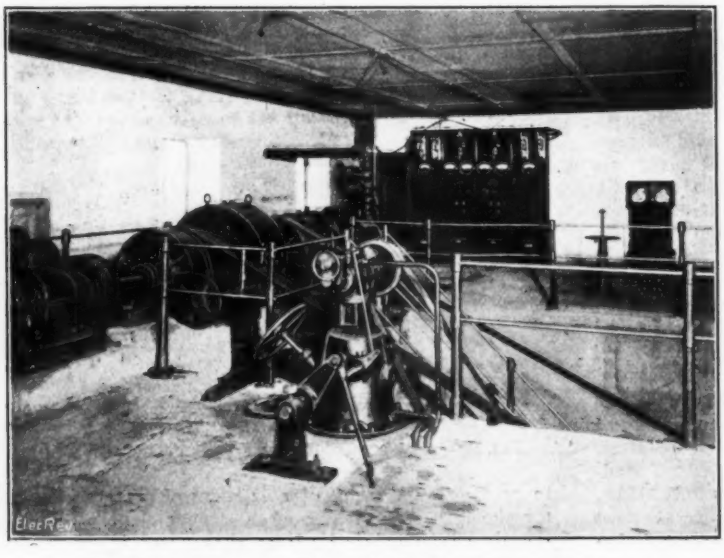


Fig. 5.—Oil-pressure Governor, Bruce Peebles Generator, Pump, and Switchboard.

Fig. 6.—High-pressure Pipe Line.

The duplication of the low-pressure turbines has a considerable advantage apart from that of overhaul. On occasions it is necessary to work overtime; the central generator is then driven by one low-pressure turbine, and for this purpose one turbine is provided with a governor. The other turbine under hand regulation drives its pump all the time.

In line with the generator driven by the low-pressure turbines are shafts carrying crowned pulleys exactly

leading up the hill to the reservoir and the 6-in. pipe for supplying the high-pressure turbine. The latter is of the Pelton type, and, under an effective head of 897 ft., develops 230 h.p.

Owing to the long pipe-line, precautions had to be taken for dealing with the water-hammer effect on shutting down the turbine suddenly in the event of the load coming off, and the Boving patent system of combined needle and deflector regulation has been incor-

porated. When the load goes off, the deflector cuts into the jet of water issuing from the nozzle and throws the power off the wheel. The needle is then allowed to move slowly forward to reduce the jet to the size corresponding with the new load, the deflector meantime taking up its position immediately above the reduced jet. In this way waste of water only takes place during the few seconds of the regulating period. The rapidity of action of the deflector and the economical control by means of the needle are thus combined.

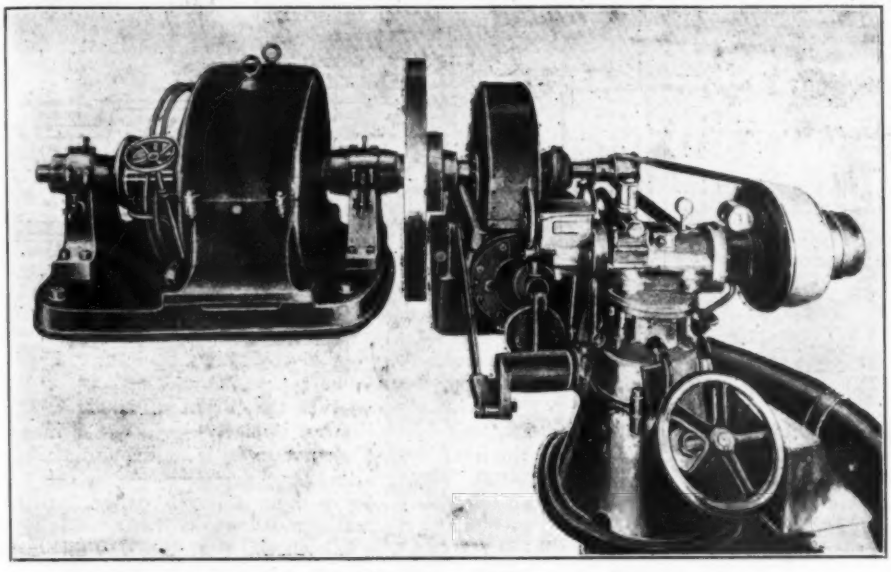


Fig. 7.—Pelton Wheel and Bruce Peebles Generator.

The Pelton wheel runs at 1,000 r.p.m., and is coupled direct to a 155-kW generator. The whole electrical system is d.c., and the pressure is 250 volts.

Fig. 2 shows one of the low-pressure turbines in course of erection in its own pit. The bulkhead shown on the left was cast into the wall, which afterwards formed one of the sides of the water-tight chamber containing the belt pulleys.

Fig. 3 shows an interior view taken from the switchboard end; the belts coming up from the low-pressure turbines and driving the central generator can be clearly seen. On the right-hand side will be seen one of the high-pressure pumps and the gear-box through which it is driven.

Fig. 5 is an interior view taken from the other end, showing the governor controlling one of the low-pressure turbines in the foreground, and the switchboard in the background.

Fig. 7 shows the 230-h.p. Pelton wheel with its generator and governor. The size of this may be contrasted with that of the low-pressure turbines, each of which has only half the output of this small Pelton wheel.

Fig. 6 shows the 9-in. pipe, through which the water is pumped to the reservoir and which brings the water down to the Pelton wheel, being laid in the trench up the hillside. For the upper portion, where the head is less than 300 ft., an ordinary slip-joint is satisfactory; but, as seen in the photograph, for higher heads the pipes are flange-jointed, the faces of the flanges being machined and rubber packing rings provided to make the joints water-tight. The static pressure at the lower end amounts to 455 lb. per sq. in.

At the outlet from the surge tower an automatic butterfly valve is fitted. If by any accident a burst should occur in the 9-in. pipe, this valve would be operated by the increase of velocity; the valve would be tripped and would slowly close under the control of a dashpot, thus cutting off the waste of water and preventing any possibility of a wash-out occurring.

One of the biggest works in connection with the whole installation is the reservoir, and a few figures may be of interest. The longest period of pumping is from midday on Saturday till Monday morning, *i.e.*, 42 hours, and at their rated capacity the pumps will in this time deliver 1,108,800 gallons. During the working hours of any one day, if the Pelton wheel were kept continuously on full load it would consume 546,750 gallons in nine hours. Allowing that one hour of the remaining 15 hours is lost each day in changing over and at meal times, the pumps could run 14 hours and replace 369,600 gallons, the deficit being 177,150 gallons per night. This, with the five hours' draw-off on Saturday, would lead to a total deficit when the week's work was finished of 1,189,500 gallons. It will thus be seen that the water used during the week from the reservoir would slightly exceed the quantity pumped into it. It must be noted, however, that this would only occur if the Pelton wheel were kept on full load during the whole of the working hours, a contingency that cannot normally arise.

Theoretically, then, a reservoir capacity of slightly under 1,200,000 gallons would be adequate. A certain margin has to be allowed to provide against the pumps being stopped for overhaul of any part of the plant, and in times of exceptional drought it might not be possible to run the pumps at full capacity. It was therefore decided to enlarge the reservoir so as to provide a surplus storage to carry over from favourable to unfavourable weeks, and a reservoir of 3½ million gallons was ultimately decided upon. The reservoir is 192 ft. square and 15 ft. 6 in. deep.

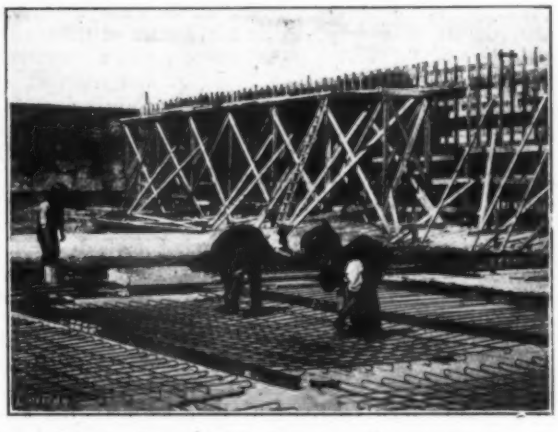


Fig. 8.—Reservoir in Course of Construction.

Owing to the possibility of the ground not being watertight, the bottom of the reservoir was formed of a 9-in. slab of reinforced concrete laid directly on the solid ground. This slab contains a light mesh of steel reinforcement to provide against any upward stresses due to changes of temperature or to hydrostatic pressure from the outside when the reservoir is empty. This meshing is shown clearly in fig. 8.

The walls (fig. 4), which vary from 8 in. thick at the top to 21 in. at the bottom, are heavily reinforced,

the reinforcement being tied in to the floor so that the walls can distribute their load on the cantilever principle. The taper of the walls was increased near the foot to provide against the bending moment, which increases more rapidly as the floor is approached. The tensile stress in the vertical rods of the wall was limited to 6½ tons per sq. in., with a view to minimising the possibility of surface cracks occurring. A mixture of 1 to 2 to 4 was used, and great care was exercised in the selection, grading, and mixture of the constituent parts. During a recent test no leakage or sweating in any part of the reservoir was observed. This is particularly satisfactory in view of the very difficult conditions obtaining at this altitude during construction.

The plant has been in successful operation now for some months. As has already been mentioned, the scheme was proposed by Messrs. Boving & Co., Ltd., who have acted as main contractors for the supply of the hydraulic equipment, including turbines, governors, generators, pumps, gears, pipes, and valves. The shunt-wound open-type generators, with their bedplates and extended shafts, were supplied to them by Messrs. Bruce Peebles & Co., Ltd., the switchgear and cables by the British Thomson-Houston Co., Ltd., the pipes by Messrs. Mechans, Ltd., and the valves by Messrs. Glenfield Kennedy. The reservoir was designed in detail by the Considère Construction Co., Ltd. Messrs. Melville, Dundas & Whitson, Ltd., were contractors for the construction work. Mr. J. Sharp, Wh.Sc., M.I.M.E., of Glasgow, acted as consulting engineer during the construction and erection of the whole of the scheme.

The cost of the scheme, including the electrification of the mills, has been stated to be about £100,000, and the resulting saving in coal, oil, labour, &c., has been estimated at £10,000 a year.

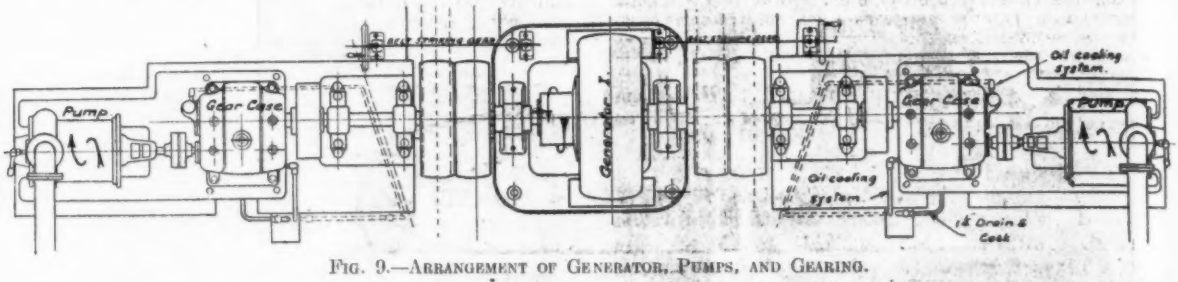


Fig. 9.—Arrangement of Generator, Pumps, and Gearing.

It will be noted that the output of nearly 500 h.p. has been secured on an initial fall of 10 ft. 6 in. only. The level of the Tweed at Kelso is 200 ft. and at Peebles 531 ft. Between these two points, therefore, lie great possibilities of cheap hydro-electric power. Between Peebles and Walkerburn alone the River Tweed falls over 100 ft., and it is to be hoped that some day this wasted power will be utilised.

THE IDEAL HOME EXHIBITION AND WELWYN GARDEN CITY.

The sixth of the series of Ideal Home Exhibitions organised by the *Daily Mail* was opened on the first of the month by H.R.H. Princess Alice, Countess of Athlone, and will remain open for 25 days. At Olympia the public will be able to examine at leisure all that goes to the furnishing and equipment of a modern home.

Simultaneously with the inauguration of the show, the model village on the outskirts of the Welwyn Garden City, in Herts, was opened by Field-Marshal Earl Haig on the 2nd inst., and there all interested in the housing problem will find practical examples and methods of household construction. The great advantage of the model village is that the houses will be available for occupation after the public has had an opportunity of studying them. No fewer than 382 designs were submitted by architects for the competition, the rules of which were framed to inspire rather than instruct competitors to adopt modern labour-saving methods. Simplicity is the keynote, and a liberal provision for the use of electricity has been made for heating as well as lighting purposes. The prize-winning designs are for medium-sized houses that can be efficiently run by one person. The point is stressed, however, that they are not museums of labour-saving "gadgets"; the results have been obtained by compact planning and careful consideration with regard to the order of the necessary housework. The village comprises 41 cottages, which represent 16 different systems of housing construction.

A feature of the Olympia exhibition is the annexe, practically the whole of which is occupied by 10 gardens designed by Royal ladies. Each is distinctive in design and all are beautifully carried out; it is almost incredible that so much of Nature's beauty could be set out on a concrete floor within the walls of a building, and the achievement is one of which the nurserymen and landscape gardeners who materialised the designs may well be proud. The gardens are illuminated by a special electric lighting scheme that combines the advantages of Mazda lamps and fittings supplied by the British Thomson-Houston Co., Ltd., and Messrs. Chance Bros.' "daylight" glass screens, which filter the light rays and to a considerable extent correct the light from the gasfilled lamps so that it more nearly approximates daylight, and thus preserves the true colours of the gardens. The display was organised by the Middlesex Hospital, to whose excellent work the extra admission fee will be devoted.

A noticeable feature of the rest of the exhibition is the improvement that has been made on last year's ideas, the general lay-out, and the exhibitors' methods of presenting their displays. There is a greater variety in exhibits, and the treatment of interiors has been much improved; thus, furnished rooms do not need to be entered, for all are open to the vision of the passer-by. The large display made by electrical firms and the attractive manner in which their products are staged is a commendable feature.

The show is well arranged in sections, and in most cases exhibits of one type have been grouped within easy distance of each other, thus making comparison easy. Kinematograph film displays, conferences, and lectures have been arranged to take place daily, and amongst the latter will be two by Mr. S. J. Harding (on March 15th and 23rd, at 7 p.m.), whose subject will be "The Modern Use of Electricity in the Home."

The majority of the exhibits are extremely attractive, although naturally somewhat outside our sphere. Various lighting systems are to be seen, and small generating sets are prominent, including all classes of non-automatic, semi-automatic, and full-automatic plant. For instance, mention may be made of the plant shown by Messrs. Rashleigh, Phipps and Co., Ltd., Mann, Egerton & Co., Ltd., Studebaker, Ltd., Hick-Diesel Oil Engines, Ltd., R. A. Lister & Co., Ltd., the Austin Motor Co., Ltd., Aster Engineering Co. (1913), Ltd., and Messrs. Wakelins, Ltd.

The "Astro" electric-light intensifier has already been illustrated in our columns; it is a metal reflector coated with silver on the inside. The "Justo" electric lamp stand can be clipped on to the edge of a table or desk, &c., so that, as its name implies, the light can be adjusted to any desired position.

The stand of the Rawlplug Co., Ltd., forms a practical and interesting exhibit; these plugs are now too well known to the trade to need introduction.

The representative selection of art glass exhibited by Messrs. Ponte, Ltd., is said to be a new departure in Venetian coloured glass. It consists principally of useful articles in almost every colour for the table, toilet, and lighting; the artistic designs are most effective, particularly when illuminated from within. It is made at Murano, in Venice, by Messrs. Barovier. The range of alabaster bowls for semi-indirect lighting, also to be seen on the firm's stand, produces an excellent decorative effect.

Fig. 1.—A Translucent Panel.

Fig. 2.—An Electric Candlestick.

Messrs. G. Ajelli & Co., Ltd., have on view plain and carved Italian Castellina marble bowls, table and standard lamps, vases, flower bowls, fruit dishes, &c., that will repay inspection.

The Z Electric Lamp & Supplies Co., Ltd., in addition to a selection of electric heating devices, introduces a new form of indirect lighting, which comprises the "Marco" translucent bowl fittings, panels, and friezes. The special feature of the bowls is that the objectionable "dead" effect of indirect lighting fittings is claimed to be overcome to a large extent. Having by daylight an appearance similar to that of white marble, they become translucent and show artistic colours when illuminated. The colouring matter is embedded in the material of which the bowls are made, so that when cleaning them there is no fear of damaging the colouring. The panels and friezes, which are moulded from the same material, form an entirely new departure in decorative lighting. The material is claimed to be fireproof, practically unbreakable, and easily cleaned. This method of lighting and panelling should be very effective in public buildings, theatres, and similar premises. Fig. 1 illustrates one of the plaques or panels which can be made to any special design, and any colour effect can be obtained by night when illuminated from the back.

Messrs. C. Aynard & F. Zimmerli are showing a Paris novelty in the form of an electric candle. As will be seen from fig. 2, the base is made large enough to contain an ordinary torch battery, the novelty of the idea being that when the candlestick is lifted by means of the stem the light is switched on, and when placed down it goes out. Constant lighting may be had also by screwing in the side nut shown.

Somewhat similar devices are the "Goblin" and the "Bogey" portable electric night lights, which are exhibited by Commercial Monopolies, Ltd., and the British & Allied Electrical Agency, Ltd., respectively. Their construction is indicated by the sketch shown in fig. 3, and is simplicity itself. A polished wood box contains the standard dry battery, the opal globe enclosing the electric bulb that lights up when the lamp is lifted by its brass handle, or when the continuous light switch A, B is in use.

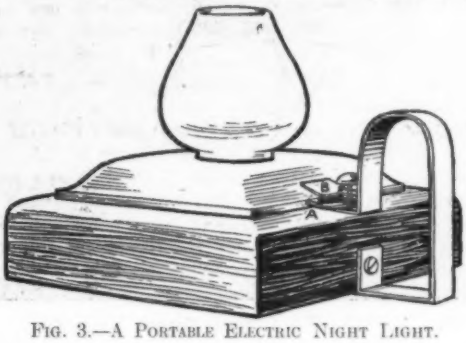


Fig. 3.—A Portable Electric Night Light.

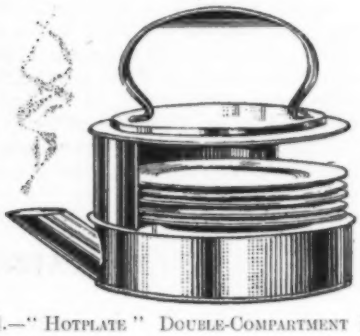


Fig. 4.—"Hotplate" Double-Compartment Kettle.

An ingenious domestic appliance of great utility is Wheeler's kettle that is exhibited by the Hot-Plate Hardware Co., Ltd. As shown in fig. 4, whilst boiling water in the lower compartment, plates or a small dish of food may be placed in the upper chamber of the kettle and kept warm without extra cost. The device should be a most useful one in the nursery or sick room, and whilst the particular "Hotplate" kettle to be seen at the show is not an electrically-heated one, it is obvious that it could be adapted with ease for that purpose.

(*To be continued.*)

OXFORD STREET LIGHTING.

RECENT DEVELOPMENTS.

Those who watch the signs of the times will note that Oxford Street, always a well-lighted street, has now become one of the best, if not the best, lighted streets in London. The St. Marylebone Borough Council has every reason to be proud of this striking improvement in this important shopping centre, and also of its enterprising Electricity Department, which carried out the work with so much success and in such a short time in order to be ready for the Royal wedding festivities.

When the idea was first put forward of making Oxford Street an example of efficient street-lighting, with a view to raising the illumination to the standard demanded by modern traffic conditions in one of the busiest thoroughfares in the metropolis, the Electricity Committee consulted its electrical engineers, who caused samples of new street-lighting lanterns to be erected. Among these was a type suggested by Mr. Haydn T. Harrison, who realised the importance of not only lighting the roads and pavements, but also the shop fronts for which this street is justly famous. It was apparent from the first that this lantern was the most suitable in every way and it was, therefore, selected, and the Council and Lighting Committee's engineers are to be congratulated on the excellent results obtained therewith.

The task of producing a sufficient number of the lanterns in so short a time was undertaken by the

Electric Street Lighting Apparatus Co., which manufactures Mr. Haydn Harrison's designs at its works at Canterbury. The special feature of the new lantern is the large light radiating surface, which is produced by the use of thin sheet glass, ground on the inner surface,

Fig. 1.—Improved Oxford Street Lighting.

the light absorption of which is very low, that at the same time completely screens the light source from the eye. The lanterns are also very substantial, only cast-iron and copper being used in their construction; the former provides a very large area of cooling surface which, supplemented by an efficient ventilating system, allows of gasfilled lamps of nearly any power being adopted. The reflector being of enamelled earthenware, no diminution in efficiency takes place due to heat, and all parts are easily cleaned.

After careful consideration and experiment, it was decided to replace the existing 500-watt units by 250-volt, 1,500-watt Osram gasfilled lamps, supplied by the General Electric Co., Ltd., and mounted in lanterns of octagonal form fitted with diffusing glass panels as described above. This combination yields an illumination remarkable for its uniformity and freedom from glare as will be seen from the photograph reproduced in fig. 1.

The lanterns are mounted at a height of 25 ft. above the street level and at an average distance apart of 160 ft. The average intensity of illumination is 2.1 foot-candles, the maximum value under the lamp being 4.0 foot-candles, and the minimum value between the posts being 0.2 foot-candles. Fig. 2 is an illumination curve showing the intensity of light on a horizontal plane 3 ft. above the road surface between two posts.

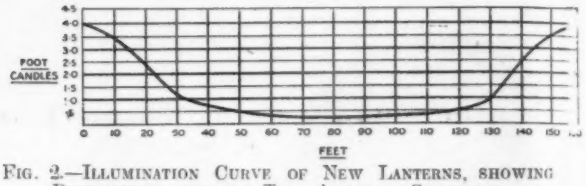


Fig. 2.—Illumination Curve of New Lanterns, showing Distribution between Two Adjacent Standards.

Oxford Street, with its new lighting and the G.E.C. floodlights on the Selfridge building, which we have already alluded to, will certainly be a bright spot in "Brighter London." The conversion was completed and finally put into commission on February 28th as a compliment to Princess Mary.

COMMERCIAL DEVELOPMENT.

(*Abstract of President's address at the* Western Centre *of the* Institution of Electrical Engineers.)

The fourth meeting of the 1921-22 session of the Western Centre of the Institution of Electrical Engineers took place at Cardiff on February 6th, and was marked by the presence of the president of the Institution, Mr. J. S. Highfield, who delivered an address on the above subject; following the meeting those present met at dinner.

In the course of his address, Mr. Highfield said that what they were up against was not the technical aspect of the profession, but the business aspect. Money had to be raised for schemes and those who found the money looked for a safe investment. Everyone agreed that the supply industry was the foundation on which the whole manufacturing industry rested. The framers of the Electricity (Supply) Bill, 1919, proposed to raise money for schemes in some rather vague way, a rather hopeless proposition, and until means were found for providing the money nothing could be done. Unless engineers kept a sharp eye on the legislative side, all the good they had done would be wiped out by the political side. Engineers did not take enough interest in the success of their fellow workers, but rather rejoiced when they saw somebody else making a mistake. Mr. Highfield briefly sketched the development of the supply industry from the discoveries of Faraday up to the 1919 Act. When in 1888 Parliament extended the tenure to 42 years, a great many pioneers took their courage in both hands and started the first electricity supply businesses. Some of the early companies were still prosperous and doing better now then they ever did. The company method of raising money was altogether preferable to the municipal one. In the former there was always the driving power—the fear that one might not be able to carry on; that sort of enterprise made for the greatest efficiency. Power stations ought to be outside the urban district. In 1901-2 most of the power companies were formed to do the very things which the District Boards were supposed to do. Mr. Highfield had studied with great interest the co-operative scheme the South Wales Power Co. was putting forward, and he thought it was an extremely good one. In supplying a district for power purposes, the suppliers had to take exactly the same chances as the manufacturer in the district; if the manufacturer went down the power supplier went down. Supplying light in a town was a pretty safe business, but the supply of power was another matter. Municipalities could not afford to make losses, and there was no chance of supplying power on a really large scale without running the risk of making a loss. It would be very much sounder if the local authorities could be shareholders in the power company itself for if the power company was successful it lowered its price and the consumer benefited. If customers were shareholders it would tend to greater stability. As he understood it, that was the scheme proposed by the South Wales Power Co.; it said "If you want a supply you must find some of the money." It was a bold move and it was possible that a better way could be found.

At the close of the address a short discussion ensued, in the course of which Mr. Chamen (engineer and general manager, South Wales Power Co.) thanked the president for the blessing which he had bestowed on his company. It was the first time he had ever heard it blessed at all. It was no use to busy themselves with high technicalities unless they could get their foundations right. They must turn to and do a bit of "under-pinning," that was what he had been doing for some time past. Some thought co-operative concerns unfair because they paid no income tax. He did not know whether that was going to be an objection to his Bill, but there was one way they could all avoid paying income tax, and that was by having no income. That had been the position of his company ever since he went down there. He would like to hear any criticisms on the Bill his company was promoting.

Mr. Morley New (City electrical engineer, Cardiff) kept clear of the contentious matters raised by Mr. Chamen as opportunities would occur to discuss those amicably in other places. He thought it was a distinct advantage to the supply side to have such a set of men as the Electricity Commissioners, who had been brought up in their own branch of the industry, to get through schemes which otherwise would have been hung up indefinitely.

Mr. Nichols Moore (borough electrical engineer, Newport) always understood that no supply undertakings could supply at a reasonable profit unless they had a large power supply to reduce proportionately the costs of production. Why lighting supplies should be allocated to municipalities and power to companies he would be glad to hear; also if the giving of a power supply was so risky to the local authority why was

it that power companies were so anxious to get that portion of supply?

Mr. D. Roberts (consulting engineer, Cardiff) knew nothing of the rights and wrongs of Mr. Chamen's Bill, but he did not see why even in that matter engineers could not pull together. There was ample room for linking up between the existing stations.

Mr. Bowman (Rhondda) wanted less politics and more common sense in Acts of Parliament. He agreed with the co-operative proposals embodied in Mr. Chamen's Bill and thought a little more co-operation would be of immense benefit to the industry.

Prof. Bacon, Mr. McWhirter, and Mr. Tremain also contributed to the discussion.

The President in the course of his reply stated that he had no idea that municipal undertakings should confine themselves to lighting entirely, but he thought they should confine themselves to their urban areas. If a municipality could benefit by buying from a company in bulk, let it do so, or if the municipality could sell to the company, let it do so. That way they would get the best results. He looked upon the Commissioners as the rampart between the trader and the consumer and understanding people in Government offices. There were many problems to be solved, and they were not going to be solved in two or three years. He knew of no man more fitted to " pull them off " than the engineer.

THE NORTH-WEST MIDLANDS ELECTRICITY DISTRICT.

Commissioners' Local Inquiry.

(*Concluded from page* 318.)

Mr. Arthur Collins (financial adviser) submitted detailed financial statistics, and estimated that the Joint Authority could supply the increased 77,000 kW the district required at £1,000,000 less than it would be possible for the individual concerns to supply it. His conviction was that the consumers in the district would save £120,000 a year under the proposed scheme.

Mr. Alfred Tyler then addressed the Commissioners on behalf of the L. & N.W. Railway, the G.W. Railway, the Midland Railway, and the North Staffs. Railway. As regarded the constitution of the Joint Authority, his clients felt there should be on the board some representatives of consumers.

Mr. Sydney Turner, on behalf of the Conference of Urban and Rural District Councils, appealed also for representation on the Joint Authority.

The inquiry was resumed on February 24th, when Mr. Collins was cross-examined at some length as to the financial aspect. This concluded the case for the promoters.

Against the inclusion of Newcastle-under-Lyme in the scheme, Mr. A. C. J. de Renzi (borough engineer) said the present capacity of the station there was 655 kW. The station was quite suitable for extension if powers to do so were granted.

Mr. Whitfield asked, if the scheme did go through, that Newcastle should receive proper and fair representation on the Joint Authority.

Mr. H. H. Joy asked that the Cannock Chase Coalowners' Association should be represented, and Mr. Onslow (consulting engineer) gave evidence in support of his contention.

Mr. Harker having opened the case for Walsall, Mr. W. Willett, chief engineer to the Birmingham Canal Navigation Co., which supplies Walsall with water for cooling purposes, said the present rate of pumping by Walsall was 560,000 gallons an hour. There would be no difficulty in increasing that figure to a maximum of 1,200,000 gallons.

Mr. W. J. Talbot (a member of Walsall Electricity Committee) said it was the view of Walsall Corporation that the district should be divided into two areas, northern and southern, to be governed by divisional boards. If it were not legally possible to so divide the district, Walsall was not prepared to support a Joint Electricity Authority for the whole district.

Replying to questions, witness stated that, if it were decided to erect a new generating station at Rugeley, he thought it extremely likely that Walsall would stand out of the scheme.

Mr. E. Lacey (civil and electrical engineer) put in statistics in support of Walsall's claim. He was of opinion that the Birchills station could be extended to meet the increased demand in the future.

Mr. Lacey continued his evidence on February 27th, when he contended that the water in the canal at Walsall was of a low enough temperature for cooling purposes. He suggested that under the scheme propounded by Walsall Corporation the collieries would get security of supply, as several stations would be linked up. To supply the Cannock district, he suggested that Walsall could link up with the main from Wolverhampton to Cannock at the sub-station. That could be done more cheaply than by building a new generating station at Rugeley. It had been suggested, witness said, that colliery developments would probably take place in the near future between Cannock Rural District and Oakengates. In such an event the new collieries could be supplied temporarily from Wolverhampton and Birchills, and subsequently by a new station erected on the Severn at Ironbridge.

Mr. Lacey was cross-examined by Mr. Tyldesley Jones about figures and estimates he had submitted to the Commission. In connection with the extensions at Birchills, including the erection of two new boiler-houses, an extension of the existing engine-house, a switch-house, a pumping-house, and a new railway siding, Mr. Lacey admitted that the permission of the railway authorities had not been obtained yet for the new siding. The existing station at Birchills was designed originally for 12,000 kW, and the new extension would mean a working capacity of 20,000 kW. They could not get enough water from the canal for cooling purposes to cope with the increase, and it was proposed, therefore, to erect cooling towers to make up the deficiency. The old workings under the Birchills site were flooded and the ground was waterlogged. He agreed that if the Walsall Corporation lowered the level of the underground water by pumping there would be serious risk of subsidence. The total cost of the proposed extension at Birchills was estimated at £460,000.

Mr. Tyldesley Jones said that Walsall's case was that it would have to pay .97d. per kWh for electricity supplied from Rugeley. Under its own scheme it claimed the figure would be only .7412d.

Mr. Harker said the Walsall scheme would be much cheaper, and would involve less capital than would be the share of the capital they would have to contribute if they went into the big scheme.

Mr. Lacey expressed the view that it would be impracticable to work one big generating station at Rugeley and keep the smaller stations as a stand-by.

On February 28th Mr. Lacey was further cross-examined, and said he was not instructed by Walsall Corporation to advise it or to prepare a scheme till last January.

Replying to the Chairman (Sir H. Haward, in the absence of Sir J. Snell), Mr. Lacey did not agree with the chairman of the Walsall Electricity Committee when he said that the Birchills scheme would mean a saving of £2,000,000 on capital cost, and £100,000 a year, as the calculations were not on a fair basis. He knew that Walsall put forward a scheme that the whole area should be divided into two districts by a line drawn roughly south of Stafford from east to west, but he had not advised the Corporation as to the expenditure necessary for the northern section.

The Chairman: So Walsall Corporation has given no consideration to the cost of dealing with the northern portion?—Witness: That is so.

The Chairman: You could only deal with the northern area by a new station at Stoke-on-Trent, by building a new station at Stafford, or by establishing midway between these two important areas a new station, such as the promoters suggest, at Stone?—Witness: I think Stone is quite a suitable site.

It would be necessary for the northern division to have its own station at Stone?—Yes.

Then I shall have to add to your proposals the cost of a separate station at Stone and the necessary means of transmission between Stone and the north?—I don't see (if it costs North Stafford more than South Stafford) why South Stafford should not have the benefit. The Commissioners would act more in the interests of South Stafford if they confined the district to the southern area.

Mr. J. H. Rider (the expert witness for the promoters) was recalled, and said the estimates for the extension of the Birchills station by Mr. Lacey were inadequate.

This concluded the evidence.

Mr. C. A. Loxton (on behalf of the Cannock District Council) wanted to be assured that they would have a permanent and an adequate supply.

Mr. Harker (for the Walsall Corporation) maintained that the evidence had shown that there were in the Birchills proposition so many possibilities for providing for the needs in five or six years' time that the Commissioners should not commit themselves to any definite opinion with respect to the merits or demerits of the two propositions, so that when the matter was put before them in one, two, or three years' time, they would then be able to present a more exhaustive and detailed scheme in support of their view that electricity could be supplied more cheaply by erecting a station at Birchills rather than at Rugeley.

Mr. Tyldesley Jones replied for the promoters and commented on the absence of opposition to the scheme, except from Walsall, and, in a minor degree, from Newcastle-under-Lyme. The promoters would take into consideration the proposal to admit representation on the Joint Electricity Authority of bodies other than undertakers. He submitted that the Birchills scheme was dead, and asked the Commissioners to decide that the district, which was the most important electrical district in the United Kingdom, should not be divided.

The inquiry then closed, the Chairman remarking that the Commissioners would announce their decision in due course.

LEGAL.

Wireless Patent Claims.

On Monday the Royal Commission on Awards to Inventors began the hearing of claims by the Lodge-Muirhead Syndicate, Ltd., and Marconi's Wireless Telegraph Co., Ltd., in respect of wireless apparatus, the patent of which they allege has been infringed by the Admiralty. Mr. Hunter Gray, K.C., Viscount Erleigh and Mr. Moritz are appearing for the Marconi Co.; Sir Duncan Kerly, K.C., and Mr. James Whitehead for the Lodge-Muirhead Syndicate; Sir Arthur Colefax, K.C., and Mr. Trevor Watson for the Crown. According to the *Daily Telegraph* report, Sir Oliver Lodge explained how in the early stages of wireless telegraphy the method of signalling was by sudden jerks. Under these conditions no selection was possible. Every station would excite all others within range. It worked only because stations were few and far between. If wireless were to develop and if stations were to become numerous, it would be essential to speak to one and exclude others. This could be achieved on a principle like that of an organ note instead of a whip crack, provided they had a receiver which could be synchronised with the radiator, and which would be incapable of responding unless it was so synchronised or properly attuned. This could only be done by the introduction of self-induction in conjunction with capacity. "Up to the time of my patent," said Sir Oliver, "neither of these ideas had entered wireless telegraphy." Sir Oliver gave a technical detailed description of his invention, and explained how by this device of signalling on different wave lengths all the complexity of modern wireless telegraphy became possible, and any one station could henceforth be listened to, to the exclusion of all others. "The value of the invention is incalculable," declared Sir Oliver, "for without it modern wireless would be impossible." He added that the method disclosed in the patent was inevitable, and was in universal use. Anyone listening at even an amateur wireless receiving set, first to a long wave station like the Eiffel Tower in Paris, then to ships in the Channel on a medium wave length, then to some great station such as Berlin, then to a short wave amateur set, then to an aeroplane operator overhead, and then back again to Paris, and who realised how completely silent the others were while one kind was being listened to, though they might be all going on at the same time, could not fail to be impressed with the perfection which tuning had attained, and how absolutely it constituted the vitals of modern wireless telegraphy.

The hearing was adjourned.

Marconi's Wireless Telegraph Co., Ltd., *v.* A. C. Cossor, Ltd.

Mr. Justice Russell, in the Chancery Division on March 1st, had before him a motion for judgment in default of defence in this case.

The action was for an injunction restraining the infringement of the plaintiff company's patents for improvements in receivers for use in wireless telegraphy and for improvements relating to vacuum tubes of the Audion type.

His Lordship made an order upon minutes which had been agreed, giving the plaintiff company the relief asked for.

Compensation Claim.

In the Court of Session, Edinburgh, last week, the widow of a coal-cutting machine man sued the Glasgow Coal Co., Ltd., for damages for the loss of her husband by an explosion of gas, and was awarded £1,200 for herself and children. For the company it was stated that deceased was working on a contract system. They also stated that the duties of examining the mine were properly carried out by them, and that the accumulation of gas was caused by a fellow workman of the deceased leaving a door open, with the result that the ventilation was short-circuited. They tendered £300.

Glasgow Corporation *v.* Alex. Stephen & Sons, Ltd.

Lord Hunter, in the Court of Session, Edinburgh, on Friday, gave judgment in an action by plaintiffs against defendants, engineers and shipbuilders, of Govan, for £3,500 damages in consequence of the partial destruction by fire of the sewage wharf at Shieldhall, over which the Corporation had acquired a permanent heritable and unredeemable right of use for loading and unloading sludge barges. The main question in the case was whether the fusing of the defenders' electric cable at or near the east end of the sewage wharf was the cause or effect of the fire. His Lordship held that it was the cause, and found for pursuers, assessing the damage at £2,750.

British Thomson-Houston Co., Ltd., *v.* Corona Lamp Works, Ltd.

Mr. Justice Astbury, in the Chancery Division on Tuesday, gave his judgment, which he had reserved, in this action. After reviewing the subject, his Lordship said that platinum was almost universally used up to 1912 for leading-in conductors, and efforts had been made to find a less expensive substitute. When it was remembered that 200,000,000 lamps were now sold every year, the importance of a substitute for commercial purposes would be realised. Plaintiffs claimed to have solved this problem, and to have invented a substitute possessing commercial advantages far exceeding any alternative previously used. This substitute had displaced platinum almost entirely, and the cost of the new leading-in wires was trivial in comparison. In construing the plaintiffs' specification, his Lordship said it must be borne in mind in determining the true construction that the first essential was that the wire should seal in the glass so as not to leak. The length of the wire was about 32 times its width, and when the glass cooled and enclosed the wire, the expansion and contraction of the wire would be largely controlled by the glass, and as the wire when cold must keep the hole stopped up, it was vital that the coefficient of expansion of the wire should approximate to that of the glass. He construed the specification as showing an aggregate coefficient which was what the plaintiffs contended for, and if he were right in that construction and the patent was valid, the lamps of the defendants complained of were a clear infringement of the claims in the plaintiffs' specification. On the question of the validity of the patent, his Lordship examined the alleged prior publications, and said he did not find the plaintiffs' invention or anything like it published or exposed in any of the prior publications relied on. The next ground on which validity was attacked was that of insufficient or misleading directions in the plaintiffs' specification. It was said that no directions were given as to whether the expansion of the wire was to be measured in a radial or longitudinal direction. He had heard the evidence of five able and experienced experts as to the interpretation of these directions, and he was of opinion that the defendants' objection on this ground was unsound. The patent was also attacked on the ground that the invention was not useful, but this plea of non-utility also failed. The plea of want of subject matter was hopeless, and in his judgment the plaintiffs' patent was valid, and claims 1 and 2 of the specification had been infringed by the defendants. The case, added his Lordship, had apparently still a long journey before it. There would be judgment for the plaintiffs for the relief claimed with costs.

Sir Duncan Kerly, for the defendants, asked for a stay with a view to an appeal.

Sir Arthur Colefax, K.C., for plaintiffs, opposed. He said the defendants were not manufacturers of these lamps, they were dealers, and plaintiffs had had litigation with them before, and there was a matter of costs which had not yet been settled.

His Lordship: If that is the fact, Sir Duncan, things must remain as they are.

PARLIAMENTARY NOTES.

The Electricity (Supply) Bill.—Viscount Peel, Chancellor of the Duchy of Lancaster, in moving the second reading of the Electricity (Supply) Bill in the House of Lords on Thursday, March 2nd, said that the measure was an amendment of the Electricity Act passed two years ago, and, unless this or a similar Bill became law, a great number of the provisions of the earlier Act would be rendered useless and ineffectual. The Electricity Commissioners appointed under the Act of 1919 had made a thorough survey of the existing conditions of the supply of electricity in the country, and had found that there was a tried and magnificent growth of every sort of system, showing great fertility of mind among those persons engaged in the creation of the industry, but a complete lack of any arrangement by which those undertakings might be linked for help or for the exchange of energy, and that any proposal of that kind was both technically difficult and financially impossible. This immense variety of systems caused enormous expense. For instance, in the area of Greater London there were now 70 different generating stations, 50 different systems of supply, 24 different voltages, and 10 different frequencies. As a result of their general survey, the Commissioners came to two main conclusions. The first was of the wastefulness and inefficiency of the present organisation for supply, and the second was the urgent need for joint action among the supply authorities, in order to economise in coal, to make better use of capital, and to produce, as a result, cheaper energy.

The general note running throughout the Bill was consent, not compulsion. It had been found that there was so general a desire for co-operation among supply companies and authorities that compulsion had proved unnecessary. Every encouragement was given throughout the Bill to private enterprise, and another important principle of the Bill was the desire to assist in cheapening the supply of electricity. Power was given under the Bill to enable the supply authorities to raise capital.

Just before the war at all public generating stations there were produced something like 2,000,000,000 units of electricity for a population of about 45,000,000. Sweden, which, of course, made use of water-power very largely, produced no fewer than 1,475,000,000 units—three-quarters of the total amount produced in this country—although the population of Sweden was only 5,000,000, or one-ninth of the population here. In 1916 no less than £91,000,000 was invested

in electrical undertakings. During the war there was a very large increase in the electrical output, and in 1918 the output totalled 4,628,000,000 units, or more than double the number of units produced in 1916. In 1920 the combined maximum demand in eight of the sixteen districts delimited by the Electricity Commissioners was 833,000 kilowatts. It was estimated that the amount would be increased in 1926 to 1,542,000, and in 1931 to 2,207,000 kilowatts. This would mean an enormous increase in output. The unit output in 1920 in these eight districts was 1,923,000,000; the estimated total for 1926 was 3,799,000,000 units, and for 1931 no less than 5,624,000,000 units or more than two and a half times the amount for 1920. This therefore, gave an increase of 165 per cent. in maximum load in 1931, and the increased output of energy in 1931 would be 132 per cent.

Under these provisions and by the establishment of these authorities it was estimated that, by 1931, there would be a saving of no less than 1,148,000 tons of coal. As to capital, the estimated saving for the South-East Lancashire district would be £1,400,000; for the North-West Midlands, £1,000,000; and for the West Riding, £644,000. The estimated saving on the annual cost of production in West Lancashire was £276,000; in the West Riding, £136,000; and in North Wales £138,000. The cost of generation in Greater London in 1919-20 was 1.55d. per unit sold, or a total of £3,927,000. In 1931 it was estimated that this figure might be reduced to 1.055d., or a reduction of 32 per cent. Applying this reduction to the 1919-20 output, the total cost would have been £2,673,000.

The Marquess of Salisbury said that the Bill was complicated and somewhat difficult to understand, and he suggested that the debate should be adjourned for a few days, in order that their lordships might have an opportunity of considering the Bill in detail.

Viscount Peel agreed to this.

On the resumption of the adjourned debate on Tuesday, March 7th, the Bill was severely criticised from many quarters of the House.

The Earl of Bessborough said that it involved compulsion and strict bureaucratic control. The development of the industry owed nothing either to the Electricity Commissioners or to the Act of 1919. In the case of London the Commissioners held an inquiry last year which lasted some weeks and cost approximately £40,000, but no scheme whatever resulted, so far as the Commissioners were concerned.

Lord Haldane also criticised the Bill, and Lord Buckmaster said that it was an elaborate proceeding to enable money to be raised by a joint electricity authority. They would find the same thing happening as in the case of the Water Board—charges would go up and rates would go up with them.

Lord Monk Bretton, speaking for the London County Council, said that it attached the utmost importance to the second reading of the Bill.

Ultimately, the second reading was carried by 59 votes to 40.

Registration of Business Names.—In the House of Commons on Monday, Mr. G. Locker-Lampson asked the President of the Board of Trade whether it was proposed to terminate the registration of business names, as proposed by the Geddes Committee.

In reply, Mr. Stanley Baldwin said:—"No, sir. The Government propose to introduce legislation which will enable the fees to be increased, so that this service may be rendered self-supporting."

Electrifying Suburban Railways.—In the House of Commons on Monday, Mr. Gilbert asked the Parliamentary Secretary to the Ministry of Transport whether any applications had been received from any of the railway or tube companies serving the London area for financial grants for the purpose of extending or electrifying their suburban or other lines in the London district; if any such grants had been given; and, if so, could he state what amounts, and to which companies, and for which lines such financial help had been granted.—Mr. Neal replied:—"I am not aware of any applications from these companies for a grant from public funds and no grant has been made. Applications for guarantees under the Trade Facilities Act have been made by the South-Eastern and Chatham and the London Electric Railway Companies and referred to the Advisory Committee appointed under the provisions of that Act, and are under consideration."

The Grampian Electricity Supply Bill.—This Bill, "for incorporating and conferring powers upon the Grampian Electricity Supply Co., and for other purposes," has been introduced and has passed its second reading in the House of Commons.

Unemployment Insurance.—On March 1st Col. J. Ward, M.P., was accorded leave to bring in his Bill for transferring the administration of insurance against unemployment from the State to each affected industry. He accordingly brought in the Bill which was introduced at the instance of the General Federation of Trade Unions, which is composed of 129 registered Trade Unions, with a membership of 1,460,000. He said that the Unions could administer unemployment insurance far more economically than the State. Mr. Clynes said he had been asked to oppose the main principle of the Bill. The State system had not yet been allowed a sufficient period of normal conditions to test the experiment. It had only just been established when war broke out.

Electricians in the Navy.—In the House of Commons Mr. Amery, Financial Secretary to the Admiralty, informed Sir C. Kinloch-Cooke that the Admiralty was fully aware of the lack of promotion in the electrician branch of the Navy, which was due to the present authorised establishment being considerably overborne. This position was not peculiar to any one branch. During the last 18 months, four retirements of officers of the electrician branch had taken place, but as the numbers now borne were considerably in excess of the authorised establishment, it was not possible to make any promotions in the vacancies. The whole question of the establishment of warrant officers to be maintained would be considered shortly.

Dover Corporation Claim.—Sir T. Polson asked whether, despite numerous applications, the Corporation of Dover was unable to obtain a settlement of an account for electricity, which account had been running on for a very considerable period, and about which there did not appear to be any question in dispute, and what was the cause of this delay?

Mr. Amery replied that a settlement of this outstanding question, which had necessitated lengthy investigation, would probably be reached at an early date. Pending such settlement, advances on account had already been made, the last of which, amounting to £600, was paid on the 22nd of February.

BUSINESS NOTES.

Bankruptcy Proceedings.—F. C. Goss, electrical engineer, 82, Windsor Road, Bishopston, and 71, North Road, Bristol.—Receiving order made February 28th on debtor's own petition. First meeting March 15th. Public examination April 21st.

J. J. Haslin, electric welder, 30, Nestfield Street, Darlington.—Receiving order made March 1st on debtor's own petition. First meeting March 17th. Public examination March 29th.

B. E. Thomas, electrical engineer, 12, Castle Meadow, Norwich.—Trustee: Mr. H. P. Gould, Official Receiver, 8, Upper King Street, Norwich, released February 6th.

W. Drysdale, electrician, 24, Paxton Street, Barrow-in-Furness.—Final dividend of 1d. in the £, payable March 11th, at 4, Ramsden Square, Barrow-in-Furness.

John Howard Hopkins, formerly trading as the Electrical Maintenance Co., 140, Wardour Street, W.—This debtor attended on March 3rd before Mr. Registrar Francke at the London Bankruptcy Court for public examination upon accounts showing one unsecured debt, £957, contingent liabilities £5,619, not expected to rank for dividend purposes; assets "nil"; and a deficiency of £957. Questioned by Mr. Vyvyan, Official Receiver, the debtor said that with £1,000 capital he commenced business in July, 1918, as an electrical engineer at 87, Shaftesbury Avenue, W., under the above style. In March, 1919, he was joined by a Mr. Hale, who introduced £3,000 as capital. The business was continued from the same address until August, 1919, and subsequently at 140, Wardour Street, W. The business was originally intended to maintain kinema electrical plants, but developed into a kinema equipment company. Of the £3,000 paid in by his partner, witness personally received £1,200, and the other £1,800 went into the business. The partnership was dissolved in September, 1920, under terms by which he took over the business and agreed to pay his late partner £5,000 for his interest therein; he had to pay £500 down in cash and the balance by weekly instalments of £40. The debtor further stated that not being conversant with the equipment part of the business, various mistakes were made, resulting not only in loss of orders, but losses on contracts and a consequent loss on the trading generally. A private meeting of the creditors was held on December 20th, 1920, when witness executed a deed of assignment, which was assented to by all but the petitioning creditor, who refused to join in the deed. The trustees thereunder were Mr. O. Sunderland and Mr. A. F. Stoy; the debts of the assenting creditors amounted to about £20,000; dividends aggregating 2s. in the £ had been paid, and he believed a further 2s. or 3s. in the £ would be distributed. For a short time after the execution of the deed he was employed by the trustee in the realisation of the estate. Witness attributed his failure and insolvency to liabilities under the judgment obtained by the petitioning creditor for cash advanced. The examination was concluded.

Vaughan Fowler, "Seacliffe," Fitzroy Avenue, Kingsgate, Kent, electrical engineer.—The following are creditors:—

	£		£
Chalk & Matthews	22	Mann & Overton	41
Coombes (G. W.), Ltd. ...	46	Pritchett & Gold and Electric	
Crawford & Co.	13	Power Storage Co., Ltd. ...	108
Dale (A. W.) & Son	10	Nenour, Miss	36
Euston, H. W.	46	Weston Bros., Ltd.	19
Bankers	100	Whithams	32

Arthur Courtenay Ince, lately trading as the Newcastle Engineering Co., now with a partner as the Tyne Electrical Industries, 21, Fenkle Street, Newcastle-on-Tyne, electrical contractor.—The following are creditors:—

	£		£
Besley, C. H.	138	General Electric Co., Ltd. ...	18
Burnham, J.	69	Lee (A.) & Co., Ltd.	36
Elder, B. S.	92	Newcastle and District Electric	
English Elec. & Siemens Sup-		Light Co., Ltd.	10
plies, Ltd.	40		

Claud Pollard, 12, Corporation Street, Halifax, Yorkshire, electrical engineer.—The following are creditors:—

	£		£
Breddon, H. V.	15	Bob, Bell & Co.	27
Gwaine, N.	106	Lawrence, J.	40
Ingham, Mrs.	117	Dyson, L	16

Percy Charles Maidment, electrical engineer, &c., 13, Beauchamp Place, London, S.W.—The receiving order in this case was made on the petition of a creditor, and last week the first meeting of creditors was held at the London Bankruptcy Court. Mr. F. T. Garton, official receiver, reported that it appeared from the debtor's statements that he commenced business in partnership early in 1916, at 164, Sloane Street, S.W., but a few months later the partnership was dissolved owing to disagrements; the debtor assumed the liabilities and assets, and agreed to pay his partner £4,250. To enable him to make the payment he borrowed £3,600 from the National Bank; £1,000 from his father; £600 from his brother, and in addition he sold his household furniture for £250. He continued the trading, but at a loss, and in March, 1921, he sold the business for £4,500 and refunded the loans. The debtor then took a fifteen months' agreement of the premises at Beauchamp Place, and carried on a similar business, until January 26th last, when the Sheriff took possession and sold off the effects. Since then the debtor had been supported by relatives and friends. The business had mainly consisted of obtaining contracts and sub-letting them, but the debtor also carried on a fair trade in electrical apparatus. He estimated his liabilities at £1,658, against assets £157, and attributed his position to general depression in trade. The estate was left with the Official Receiver to be wound up in bankruptcy.

R. H. Liddell (Liddell & McInnes), electrical engineer, 4, The Crescent, Carlisle.—First meeting March 15th, at the Official Receiver's office, 34, Fisher Street, Carlisle. Public examination March 20th.

Company Liquidations.—Grafton Dynamos, Ltd.—In voluntary liquidation. Meeting of creditors, March 17th, at 145, St. Vincent Street, Glasgow. Liquidator: Mr. J. W. MacKinnon.

F. O. Read & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. C. H. Nathan, Norfolk House, Norfolk Street, Strand, W.C. Meeting of creditors, March 14th, at Donington House, Norfolk Street, W.C. Particulars of claims to the liquidator by April 15th.

Semco, Ltd.—Winding up voluntarily. Liquidator: Mr. F. B. Darke, 146, Bishopsgate, E.C.2. Meeting of creditors, March 16th, at the Abercorn Rooms, Great Eastern Hotel, Bishopsgate, E.C.

Thanet Electric Co., Ltd.—Winding up voluntarily Liquidator: Mr. H. Kirby, 840, Salisbury House, E.C. Meeting March 20th at the Institute of Chartered Secretaries, 59a, London Wall, E.C.

Snercold Engineering Co., Ltd.—Winding up voluntarily. Liquidator: Mr. W. Reacher, 46, Basinghall Street, E.C. Meeting March 17th.

Midland Electric Rotary Blowing Co., Ltd.—Winding up voluntarily. Liquidator: Mr. J. W. Massey, 46, Cherry Street, Birmingham. Meeting was called for March 9th.

Noyes, Stockwell & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. A. W. Hoale, of Messrs. Hoale, Smith and Field.

Dissolutions of Partnership.—Gorton Welding & Engineering Co., acetylene and electrical welders and millwrights, Sunnyside Works, Tanyard Brow, Hyde Road, Gorton, Manchester.—Messrs. T. E. Forster, D. Greig, and T. Gee have dissolved partnership.

W. E. Weekes & Co., electrical and telephone engineers.—Mr. C. H. Clarke and Mr. W. C. Davey have dissolved partnership. Mr. Davey will attend to debts and continue the business.

Firth & Russell, electrical engineers, Shafton Lane, Holbeck, Leeds.—Mr. A. S. Russell and Mr. H. F. Moore have dissolved partnership. Mr. Moore will attend to debts and continue the business.

Herne & Co., builders, decorators and electricians, 17, Motcombe Street, S.W.—Messrs. C. T. Herne and F. G. Pitt have dissolved partnership. Mr. Herne will attend to debts and continue the business.

Trade Announcements.—Messrs. Electrical Components, Ltd., have taken premises at Nos. 88 and 89, Great Charles Street, Birmingham (adjoining those now occupied), and they will be opened as a warehouse and showrooms. A leaflet giving reduced prices of conduit fittings has been issued.

The Urban Electric Supply Co., Ltd., has transferred its offices and showrooms at Grantham, from East Street to 34, St. Peter's Hill.

Messrs. Alfred Danks, Ltd., of Gloucester, have purchased the Emlyn Works, to which premises the operations now carried on by them at the Westgate Iron Works, and by Messrs. J. M. Butt & Co. at the Kingsholm Foundry, will eventually be transferred. The general engineering business and the making of wrought-iron pulleys and the work of the grey iron castings foundry will be concentrated at the new works, giving increased output and quicker dispatch.

Mr. Bernard L. Myer announces that he has now entirely discontinued the business of the Electric & Engineering Specialities Co., of which he was the proprietor, and he has been appointed sole representative for Messrs. Napier-Kimber, Ltd., wholesale electrical distributors and merchants, of London, W., for the district of South-West Lancashire, including Liverpool, also for Cheshire, North Wales, and the Isle of Man.

Messrs. A. W. Beuttell, Ltd., have removed to 53, Victoria Street, London, S.W.1.

Mr. F. H. Blaxley having given up direct representation of the New Gutta Percha Co., Ltd., is now factoring Pernax wires and cables at 177, Corporation Street, Birmingham, where all communications should be addressed.

Catalogues and Lists.—Messrs. Campbell & Isherwood, Ltd., Raleigh Street Works, Bootle, Lancs.—A well-illustrated catalogue of electrical machinery for marine and industrial purposes, including generating sets, welding plant, motors, motor-generators, fans, cranes, hoists, tools, &c.

The Jeary Electrical Co. Ltd., 8, Lambeth Hill, Queen Victoria Street, E.C.4.—A comprehensive catalogue of electrical accessories, such as bells, accumulators, switchgear, lamps, conduit, wires and cables, motors, lighting fittings, &c. Priced and illustrated.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—A series of small illustrated pamphlets dealing with the "A. B. C." electric washer, the "Holiday" electric dish washer, the "Reco" general utility kitchen motor, and the "Sunshine" electric vacuum cleaner. Also List No. 348, giving illustrations and prices of "Sunlite" reflectors of many types; List No. 35, dealing with the "Super Switch Plug"; List No. 350, describing the "Sunco" insulator testing set; and List No. 352, advertising various patterns of electric lamps.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.—Publication No. 6027, an illustrated description of "Igranic" theatre light-dimming equipment, including views of installations.

Credenda Conduits Co., Ltd., Whitehouse Street, Aston, Birmingham.—An illustrated pamphlet describing a new protective device for electric water-boiling appliances.

Messrs. Spicer & Co., Ltd., 41, Red Lion Street, Clerkenwell, E.C.1.—A price list of electrical appliances and accessories, including cables, wires, batteries, motors, kettles, lighting fittings, &c.

Messrs. Gyer, Hill & Gyer, 661-663, Harrow Road, Willesden, N.W.10.—A price list of Government surplus goods, including fencing, pumps, wagons, telephone equipment, tools, &c.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—February price list of electrical accessories of all kinds.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—Leaflet L.217, illustrating four examples of electric table lamps.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Monthly Magazine for March, with usual stock lists of a.c. motors and d.c. motors and generators; also notes on their manufacture, and humorous items.

The Rawlplug Co., Ltd., Gloucester House, Cromwell Road, S.W.7.—An illustrated leaflet giving instructions for the arrangement of a "Rawlplug" window display.

Brittain's Electric Motor Co., 110, Cannon Street, E.C.4.—A postcard, illustrating several of the firm's manufactures.

Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, E.—List 150A, giving numerous illustrations of the firm's ebonite productions.

Receiverships.—W. A. & R. J. Jacobs, Ltd.—A. E. Newman, of 171, New Bond Street, W., ceased to act as receiver or manager on February 1st, 1922.

Commercial Travellers and Railway Charges.—The National Union of Commercial Travellers has written to the Railway Clearing House urging a reduction in the charge now made for commercial travellers' week-end tickets and a re-introduction of reduced cloak-room accommodation charges.

Social Events.—The G.E.C. Travellers' Dinner was held on Friday, February 24th, at the Old Falstaff, Cheapside, E.C., with Mr. H. W. Roberts, London sales manager, in the chair. He was supported by Mr. M. J. Railing, general manager of the General Electric Co., Ltd., Mr. L. C. Gamage, secretary, and several of the London departmental managers. The function was organised by Mr. E. A. Joyce. After interesting speeches by the chairman, Mr. Railing, Mr.

Gamage. Mr. Riley, and Mr. Joyce, a musical programme, under the direction of Mr. Ashman, was given.

The tenth annual dinner of the staff of Messrs Ferranti, Ltd., was held on Friday last, at the Midland Hotel, Manchester, and was followed by a dance. The chairman of the company, Mr. A. W. Tait, C.B E., received the guests and presided over the dinner. The usual toasts were interspersed with musical items, including the song "My Old Shako," with chorus, by Mr. Campion, rendered for the tenth year in succession and now known as the Ferranti Anthem. This part of the evening ended with a few "Chestnuts" by Mr. W. E. Warrilow.

Book Notices.—"Sell's Registered Telegraphic Addresses and Classified Trades Directory of Great Britain and Ireland." London: Henry Sell. 45s. (with supplementary edition).—This publication has now reached its 37th year, and it is a very bulky volume of over 3,000 pages, containing particulars of 100,000 firms having registered telegraphic addresses. The inland abbreviated addresses are from the Postmaster-General's official lists, and the telephone numbers are also given. There is an alphabetical section with marginal number for every name to facilitate cheaper cabling of names and addresses; also a Classified Trades list. The book is the only one of its kind, and is very useful to traders.

Institution of Electrical Engineers.—List of corporate and non-corporate members of the Institution. London: The Institution.

The Librairie Vuibert, 63, Boulevard Saint-Germain, Paris 5e, has sent us an abridged catalogue of technical and educational publications, together with leaflets advertising books on the French steel industry and wireless telegraphy for amateurs.

"The *Journal* of the South African Institution of Engineers," Vol. XX, No. 7, February, 1922.—Included in this number are papers on "The Working of Tungsten" and "High Lift Turbine Pumps."

The Johannesburg Strike.—Serious rioting has been reported during the past fortnight, and Johannesburg has been deprived of light and power several times. Upon the last occasion the technical staffs left the stations complaining that the protection afforded them was inadequate. It was announced on March 3rd that the Industrial Federation had decided to take a ballot of its members upon the terms put forward by the Chamber of Mines.

The Leipzig Fair.—The annual Sample Fair was officially opened on March 4th. The *Daily News* Leipzig correspondent states that there are 13,000 exhibitors this year. In the technical and building fair imposing exhibitions have been arranged by the A.E.G. Krupps, and various Stinnes interests, which indicate very active competition from Germany in the electrical industry.

Russian Local Electrical Trust.—According to a message from Moscow, a trust is being formed in the Tver Government embracing nine electric stations.

Electrical Contractors at Coventry.—Last week electrical contractors in Coventry met to consider proposals to establish an association for the city and district to promote goodwill and fellowship in the trade and to guard the public against many evils brought about by cheap class of work and to generally unlift the conditions of the trade. Mr. C. Payne occupied the chair, and Mr. R. Verney the vice-chair. Mr. F. C. Brown (Messrs. F. C. Brown & Co.), the promoter of the meeting, urged that if they formed an association and members met regularly, they could air their grievances, and, after investigation and discussion, could effect practical reforms. They were acting as free agents of the city electrical undertaking and introducing really profitable customers without the least recognition. When they were organised, their committee could wait upon the Electricity Committee and get a concession by way of cheaper rates for "juice" in return for demonstrating and advertising the use of the electricity supplied by the undertaking. By combination they could reduce their own newspaper advertising expenses and join in warning propaganda regarding the sale by some unknown travelling electricians of lamps and the many ridiculous contrivances supposed to increase the amount of light. A sore point connected with the electrical trade in Coventry was contained in a letter to a local newspaper, stating that more work could be found for electricians if the men employed in the works could be prevented from doing jobs on his own at night and on Sundays. The speaker went on to refer to the national scheme for disabled men and King's Roll. With regard to prices, he thought the members would welcome their committee getting down to rock bottom facts in the obtaining of better prices and carrying out really good-class jobs. He was sure that their committee could draft standards hitherto unknown outside the L.C.C.'s rules and regulations. Some discussion followed, and a committee was appointed to frame rules, the members being: Mr. R. Verney (H. W. Burbidge & Co.), Mr. G. Marson (Norton & Marson, Ltd.), Mr. Skidmore (Coventry Electric Co.), Mr. F. Hutt (Hutt Bros.), Mr. Beesley (Lee, Beesley and Co.), Mr. G. Marson (G. Marson, Ltd.), Mr. Muddiman (Harris & Muddiman), and Mr. G. Laird (Laird & Jury), Mr. Brown to act as hon. sec. *pro. tem.*

Chinese Notes.—Chung Hsih Electrical Co., Soochow Kiangsu, has been amalgamated with the Soochow Electric Co. The latter was established in 1920 to compete with the Chin Shing Electrical Co., a part of which is owned by Japanese.

The Chief of the Telephone Bureau, Li Sin-hwei, plans to install a central exchange at Chang-ansze, Chungking. The original telephone administration, established under the auspices of the Chungking Police Administration, is to be amalgamated with the new bureau, and all the old machines will be replaced by new purchases. The Bureau is also to be placed under the direct supervision of the Ministry of Communications.

The original Chinese Merchants' Electric Light Co. at Chungking has been advised by the authorities to purchase new machinery and to take immediate steps to reorganise the company on a more profitable and efficient basis. Preparations are proceeding.

The Engineering Bureau has already appointed a German engineer to undertake the survey of roads.

Several privately-owned machine shops at Shanghai have decided to amalgamate and combine their capital for the establishment of machinery works at Chungking.

The Civil Governor of Chihli reported to the Ministry of Agriculture and Commerce that "the establishment of the Peitaiho Coastal Hydro-Electric Co. by Chu Chih-chien *will do no harm to the place.*"

The Lung-Yen Mining Co. formerly depended on Hanyang and other iron works for smelting the iron ore it produced, but sending the ore from Peking to Hankow for smelting was far too costly a process, and this accounted for the high cost of the pig-iron produced. The company therefore decided to build a blast furnace. This is now under consideration near the Western Hills. Work was begun in October, 1920, and will be finished by April, 1922. The furnace will have an average producing capacity of 250 tons of pig iron every 24 hours. The equipment includes, besides the furnace, five Wickes vertical tube boilers of 2,500 h.p., three electrical generators of 2,500 kW, two turbine blowers, four stoves, and a number of pumps. The equipment, costing $1,160,000 in U.S. currency, was ordered through the American Trading Co. Eight hundred labourers are now engaged in the construction work, under the supervision of three Chinese engineers, all of whom are returned students from America.

Lead.—In their report, dated March 4th, Messrs. James Forster & Co. state that the rise for the week was due to reports that the Penarroya Co. had given notice that, owing to the strike at the mines, they might not be able to deliver on March contracts. The imports this year, so far, have been far above consumption, and there is no indication of expansion in either the building or electrical trades.

Local Exhibitions.—An Ideal Homes Exhibition, under the patronage of the Corporation, will be held in Paisley from April 17th to 29th.

Arrangements for the Hackney electrical exhibition, which is to be held from April 24th to 29th, have been completed, and a number of representative firms have taken up the whole of the available space. The exhibition will include all kinds of lighting, cooking, and heating appliances and other domestic apparatus.

Patents Restoration.—Orders have been made restoring the following patents granted to Dr. Curt Stille:—No. 12,709 of 1912, for "Improvements in telegraphic photography." No. 9,061 of 1913, "Improvements in optical receivers for facsimile telegraphs."

"British Trader."—The Orient liner, *Orontes*, a liner on the Australian trade of rather more than 9,000 tons, has been sold to a syndicate which is converting her into an exhibition ship at once. While the *British Industry*, which is to be specially designed for her work from truck to keelson, is definitely held up for a year in the hope that trade prospects will improve, as noted in our last issue, the *Orontes* is scheduled to sail on May 1st. She should have completed her forty-thousand-miles cruise by next January. She is to be renamed *British Trader*. Comparatively few alterations will be made, the present extensive first and second-class accommodation being used for the stallholders as living places and offices, while the steerage quarters and big 'tween-decks and holds will be fitted up with nearly 300 stalls. Particular attention is to be paid to the machinery and motor trades.—*Evening News.*

"Little Gluttons."—The new White Star liner *Homeric* is equipped with "Little Glutton" vacuum cleaners, supplied by the manufacturers, the Edison Swan Electric Co., Ltd.

East African Electrical Company.—We are informed that a company is now being formed at Nairobi, Kenya Colony, called the East African Power & Lighting Co., to acquire the undertakings of the Nairobi Electric Power & Lighting Co., the Mombasa Electric Co., and other electrical interests in the Colony. The undertaking of the Nairobi Electric Co. and all its assets have been duly transferred and paid for in cash, and the purchase price received in London, and the company will go into immediate liquidation. Mr. G. A. Hiclett, director and secretary of the company, is the intended liquidator.

In the machinery group internal-combustion motors pay *ad valorem* duties according to the fuel employed, the duties being 15 and 25 per cent. (second column) and 30 and 50 per cent. (first column), according to whether the engines weigh over or under 1,000 kg. Diesel and semi-Diesel engines pay 30 to 60 pesetas (first column) and 10 to 20 pesetas (second column) per 100 kg. Detached parts of internal-combustion engines are heavily taxed at 450 and 150 pesetas per 100 kg., according to column. Steam engines, land and marine, are subject to duties ranging from 120 to 300 pesetas (first column) and 40 to 132 pesetas (second column) per 100 kg.

Steam turbines pay, according to weight, 140 to 260 pesetas (first column) and 35 to 65 pesetas (second column) per 100 kg. Hydraulic motors are taxed at 105 to 160 pesetas per 100 kg. (first column) and 35 to 80 pesetas (second column).

Locomotives weighing over 55 tons for railways with a gauge of over one metre pay 210 and 105 pesetas per 100 kg., according to column.

Machine tools for working metals pay, according to weight, 90 to 195 pesetas (first column) and 30 to 95 pesetas (second column), in each case per 100 kg. The corresponding duties for wood working machine tools are 150 to 275 pesetas and 50 to 110.

Electrical material, dynamos, electromotors, ventilators, transformers, magnetos, starting switches, rheostats, &c., pay, according to their weight, 135 to 500 pesetas (first column) and 45 to 200 pesetas (second column) per 100 kg. The duties on incandescent lamps, complete, are fixed at 36 and 12 pesetas per kg., according to column.

According to the law of 1906, the Spanish Government has only three months in which to modify any of the duties contained in the tariff just published.—*Reuter's Trade Service* (Madrid).

A complete translation of the new tariff has been prepared by the Board of Trade, and was issued as a supplement to the *Board of Trade Journal* of February 23rd. The tariff became fully operative on February 16th.

Hydro-Electric Plant for Argentina.—According to information which has reached Sweden, the Minister for Public Works in Argentine has placed at the disposal of Mr. Nils Hofstedt, secretary of the Swedish-Argentina Commission, a communication concerning the possible exploitation of two waterfalls, the Iguazu and the Salto Grande. The Iguazu fall has a fall of about 6.3 metres at ordinary high water and its calculated capacity is 125,000 kW. The plant, according to an investigation, has been computed at 12 turbines each of 23,000 h.p., preferably high-speed turbines. Three-phase generators for 220,000 volts are proposed, and transmission is to extend to 724 miles. Particulars of the details to be embodied in the estimates of expenditure will be furnished by the Minister to interested firms in Europe. Offers are also required for the utilisation of the Salto Grande in the Uruguay river, where the variation in the fall is from 23.50 metres and 12 metres. The plant suggested is for 50,000 kW, with units of about 10,000 kW.

New French Companies.—There has been formed at Paris (4, Rue Nicolet Charlet)) the Société d'Enterprises Electro-Mécaniques (Ch. Moussard et Cie.) with a capital of 110,000 fr. for the objects indicated by its title.

The Société d'Electricité de Mathamis has been embodied at Corpentras (28 bis, Avenue de Pétrarque) with a capital of 2,000,000 fr. in 250 fr. shares, 240 of which are allotted to the Compagnie Minière du Sud-Est as consideration for its assets. The objects of the company are the working of concessions of all kinds related to electricity.

With a capital of 1,000,000 fr., the Energie Electrique de l'Auxois has been constituted at Précy-sous-Thil (Côte d'Or) for the generation and distribution of electricity. The capital is in 500 fr. shares, 100 of which are allotted to M. Andre. the founder, as consideration for his assets.

There has been launched at Sales (Cantal) the Société Electrique "le Roc des Bans," with 1,000,000 fr. capital, for the development of waterfalls, and the production and distribution of electrical energy. 800 500-fr. shares are allotted to M. Margne as remuneration for his assets.

Swedish Telephone Interests in Poland.—Since the expiration, with the year 1919, of the Warsaw telephone concession held by the Swedish Cedergren Telephone Co., negotiations have been proceeding between the latter and the new Polish State, which have now been brought to a close. An agreement has been reached under which the Swedish company and the Polish Government will form a new company which will take over the Warsaw undertaking and also the State systems at Lodz, Lublin, Lemberg, Bialystok, Sosnowiac, and Dobrowicz. The concession for all the undertakings is for 25 years. The Swedish company will hold four-sevenths of the share capital, which amounts to 18,000,000 French francs, and a loan of 15,000,000 Swedish kronen is also to be raised.

State Nitrate Works in Norway.—The Norwegian Government has under consideration the question of establishing State works for the production of nitrate by the arc process, a scheme for which has been put forward by Mr. T. C. Hagemann, formerly engineer with the Norsk Hydro. The scheme contemplates the utilisation of the spare 75,000 h.p. which is or will be available at the Glomfjord hydro-electric works.

For Sale.—Londonderry Corporation Electricity Department invites offers for one 100-kW B.T.H. generator with Allen compound enclosed engine, and switchboard panel.

Messrs. Greetham & Son will sell by auction, on March 15th at 281, West Derby Road, Liverpool, electrical plant, consisting of petrol-electric generating sets, switchgear, &c.

Chesterfield Corporation Electricity Tramway and Motor Bus Departments have for sale a Chloride storage battery and charging booster, complete. (See our advertisement pages to-day.)

The A.E.G. and Russian Business.—It is of some interest to hear what a French correspondent at Berlin has to say on this question. He states that the contest between Herr Stinnes and Herr Rathenau is well known at Moscow, and that all the sympathies of industrial and commercial circles there are for Herr Rathenau, who has long enjoyed great popularity in Russia, where the A.E.G. established many electrical undertakings. Its correspondent further states that Herr Rathenau is supported in Russia by M. Krassin, who for many years was in the service of the A.E.G., and that former industrialists and the "new rich" who have leased works and established large technical departments prefer to get into touch with a group which possesses the powerful support of M. Krassin. All these statements are made in connection with the recent arrival in Moscow of a representative of Herr Stinnes, which representative is said to have been given the cold shoulder by former Russian industrialists.

A Tax on Consumption.—As a means of increasing the national revenue in Germany, a proposal has been brought forward for the imposition of a tax on the consumption of gas and electricity. A similar scheme was advanced and rejected as far back as 1908.

Wages and Conditions in the Tramway Industry.—Agreement upon a number of points was reached at a meeting of the Joint Industrial Council for the Tramways Industry, held on March 3rd. The principal question discussed was that of the guaranteed 48-hour week. It was announced that the employers had agreed to retain the guarantee for those at present employed, but new entrants, up to a maximum of 10 per cent. of their number, will receive a 32-hour guarantee only. A further meeting of the Council was to have been held yesterday (Thursday), when a number of other important matters were to receive attention.

Indian Duty on Electrical Apparatus.—According to a Reuter dispatch from Bombay, the principal users and suppliers of electrical apparatus have submitted a memorandum to the Indian Fiscal Commission praying for a reduction of duty on electrical apparatus from 11 per cent. to 2½ per cent. *ad valorem.*

Unemployment.—A further decrease was shown in the last Ministry of Labour returns of registered unemployed, the total being 1,837,233 on February 28th, as compared with 1,861,815 a week earlier. The number of persons engaged on special relief schemes was 128,500 on February 18th.

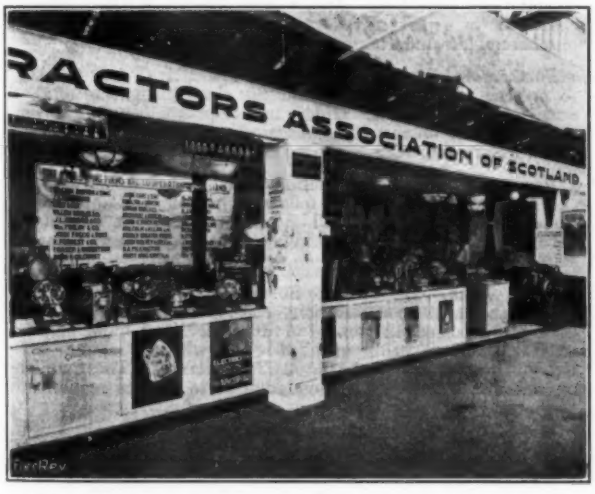
India and the British Empire Exhibition.—In the Legislative Assembly a resolution recommending that the necessary steps should be taken for India's participation in the British Empire Exhibition in 1924 was animatedly discussed. Mr. C. Innes, Commerce member of the Council of State, estimated that the total cost would be 15 lacs of rupees spread over three years. The Council had decided, in view of the heavy deficit in the forthcoming Budget, to ascertain the sums the Dominions would be likely to contribute before deciding on India's participation.—*Reuter* (Delhi).

An Exhibition at Harrods'.—The increasing activity of the large London stores in electrical matters is very gratifying. These huge "emporia" have an influx of visitors that no existing purely electrical store could cope with, and people who go there with no intention of purchasing electrical goods become interested and contract the desire to possess some of the wonderful things they see. One of the latest movements is the "Modern Homes" exhibition now in progress at Messrs. Harrods'. Here a proper classification of appliances has been made, and the temptation to show everything the space will hold has been resisted. A part of the second floor has been divided into compartments to represent the various rooms of a house. There is a bathroom with a Benham towel rail, a small Carron fire, and a hair-dryer; a kitchen complete with cooker and utensils; a home laundry containing a "Thor" washer, an ironing machine, an iron, and an electric (Jackson) boiler; then there is a series of "rooms" decorated in various fashions with appropriate lighting. In the centre of these the Hotpoint Co. has a stand bearing numerous examples of its products, and the Hoover vacuum cleaner is demonstrated. An electric grand piano is also included and dispenses music not altogether devoid of the "human touch." The display was organised by Mr. T. M. Rogers, manager of the Building and Electrical Department, and he and his staff may well be proud of the result.

E.D.A. Salesmanship Conferences.—Mr. H. Marryat, M.I.E.E., will occupy the chair at the next E.D.A. salesmanship conference to be held at the Chartered Institute of Patent Agents on March 17th. Proceedings will open with a talk on "Salesmanship in Relation to Showroom Display and Demonstrations" by Mr. A. C. Bostel.

The British Industries Fair.—*The Times* announces the receipt of a number of letters advocating the opening of the British Industries Fair to the general public. If it was not possible to extend the fair, it was suggested that the daily hours should be extended so that the public could inspect the display in the evening.

Edinburgh Contractors' Enterprise.—The Ideal Homes Exhibition, held in the Waverley Market, Edinburgh, was brought to a close on Saturday last. The largest and most varied display was the joint exhibit of the Edinburgh members of the Electrical Contractors' Association of Scotland. The arrangements were in the hands of a small acting committee of the Association, consisting of Messrs. A. Pratt, D. S. Munro, W. Mackintosh, and Mr. W. Finlay, the secretary, and these were enthusiastically supported and assisted not only by the contractors, but by manufacturers and factors. The stand (which is shown in the accompanying illustration) was wired throughout by c.t.s. cable and designed to show the varied appliances effectively. Five distinct schemes for lighting were fitted for use in succession or in combination—A stage or shop-window effect with "Holophane" angle reflectors fitted with "Fullolite" lamps; a ceiling-reflector effect by means of a variety of alabaster, "Luna," and other glassware bowls and urns; a general display of fittings representative of those used in the public rooms and bedrooms of a house and carefully selected for their beauty or novelty; a daylight effect obtained by banks of concealed "Ediswan" colour-matching lamps; and a beautifully soft and glowing effect by floor and table standards with silk shades. Notable in this section were "Dragon" and "Parrot" designs by Louis Dernier & Hamlyn, Ltd., and some striking French bronzes which had been lent by the General Electric Co., Ltd. Over a hundred different patterns of electric heaters were arranged so that they could be switched on individually. Well-tried makes, such as the "Tricity," the "Dowsing," "Belling," and the "Emanef" were shown in great variety. Vacuum cleaners were represented by the "Jackson," "The Little Glutton," "Imperial," "Electrolux," and the "Jeary," and the varying qualities of these were in constant demonstration. The "Universal" and "The Time-Saver" electric washers in action proved interesting to many visitors. Several sizes of motors were coupled up, and country house lighting plants were represented by the "Petter" and the "Armstrong Whitworth" semi-automatic sets. Boards and cases illustrating Simplex conduits, "Stannos," and "Henley" wiring systems appeared. The lamps of all the E.L.M.A. makers



Contractors' Stand at the Recent Edinburgh Exhibition.

were represented on the stand, and also cases illustrating their stages of manufacture. The air was varied by the action of several oscillating and fixed fans and "Ozonair" machines, and the constant sparkle and crackle of the violet-ray producers gave the stand a thoroughly electrical atmosphere. Practically every kind of electric iron was represented, from the small universal type which a lady may carry in her hand-bag to the largest size of tailor's goose. Many styles of bed warmers were exhibited, among those being a form operated by an ingenious safety switch and several of the new "Dowsing" pattern. Electrical hair dryers of various descriptions, curling-tong heaters, massage and high-frequency outfits were demonstrated. Electric toasters were shown in several forms, some of these having ingenious reversible bread carriers. There was a profusion of electrical novelties, such as G.E.C. pipe and cigar lighters, egg testers and accumulator, dry-cell and magneto hand lamps.

Electric cooking and heating were kept to the forefront by a profusion of grills, kettles, percolators, saucepans, and water boilers. "Jackson" and "Tricity" ovens and stoves were in evidence, and much interest was evinced in the cooking demonstrations by a capable lady from Tricity House. A few days after the opening of the Exhibition, the contractors entertained the Lord Provost, the Convener of the Electricity Committee, and Mr. Newington, the city electrical engineer, at a lunch in the Exhibitors' Club, which had been entirely cooked by electricity on the Association's stand. The operation of the stand was undertaken by daily relays of representatives from the firms concerned.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries:—

Parsiwatt. No. 418,559. Class 13.—Electric light fittings of ordinary metal. La Société l'Electro-Construction, 86, Boulevard Gambetta, Paris. September 14th, 1921.

Durex. No. 418,595. Class 13.—Junction boxes and fittings for electric light and power installations. Harold F. McLoughlin, 601, Bordesley Green, Little Bromwich, Birmingham. September 16th, 1921.

Maxivolt. No. 420,191. Class 1.—Compressed tablets of sal-ammoniac for use in electric batteries. Bush, Beach & Gent, Ltd., 10, Union Court, Old Broad Street, London, E.C. November 4th, 1921.

Armature and circle design. No. 405,596. Class 6.—Electric motors, magnetos, dynamos, electric fans, blowers, &c. No. 405,597. Class 8.—Electric cables, electric batteries, and accumulators, induction coils, transformers, &c. No. 405,598. Class 13.—Electric fuses or cut-outs, sparking plugs, electric internal switches, electric horns, &c. Robert Bosch Gesellschaft, Militarstrasse, Stuttgart, Germany. June 28th, 1920.

Witton. No. 418,205. Class 8.—Dry cells (electric). The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. September 6th, 1921.

Witton. No. 417,029. Class 6.—Dynamos and electric motors. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. July 16th, 1921.

Paracore. No. 420,228. Class 8.—Electric cables. United States Rubber Co., 1, Little Burnet Street, New Brunswick, N.J., U.S.A. November 11th, 1921.

Prest-O-Lite. No. 413,304. Class 8.—Electric storage batteries. The Prest-O-Lite Co., 30, East 42nd Street, New York, U.S.A. March 10th, 1921.

Sphinx. No. 419,655.—All goods in Class 11. The Sphinx Manufacturing Co., Ltd., 240-2, Bradford Street, Birmingham.

Tungola. No. 419,580. Class 13.—Electric lamps and parts, fittings, lampholders, &c. Osram Gesellschaft, 11-14, Ehrenbergstrasse, Berlin, 017, Germany. October 17th, 1921.

Nico. No. 421,606. Class 13.—Electric lamps (ordinary), fittings and accessories. The New Inverted Gas Lamp Co., 19-21, Farringdon Avenue, London, E.C. December 17th, 1921.

M.I.C., Empire Works, Walthamstow (lettering and design). No. 420,136. Class 50.—Electric insulating material. Micanite and Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow. November 2nd, 1921.

The Worthing Contract.—The recent decision of the Worthing Town Council to accept the tender of Messrs. Mirrlees, Bickerton & Day, Ltd., for the supply of a Diesel engine for the Corporation generating station in preference to that of a German firm whose quotation was nearly £4,000 lower, has aroused a good deal of criticism. One of the communications since received by the Electricity Committee took the form of a resolution of thanks from the National Union of Manufacturers, while another was from a local resident, who quoted three different instances in which German electrical plant was supplied before the war to electricity undertakings in Shanghai, Melbourne, and Cape Town, which were all found defective in working and by which, despite the makers' guarantees, no satisfaction was ever given, whereas in the Shanghai station a similar engine installed by a British maker was found to be in perfect condition after nine years' working. On the other hand, the Committee had a petition signed by 19 ratepayers expressing their amazement and dismay at the decision, and announcing their determination to oppose any application for a loan by every means in their power. In reply to the latter threat, the Committee now states that the sanction of the Electricity Commissioners has been received to the necessary loan, and that the contract will be executed in due course. The Committee further reminds its critics of the fact that the extra cost of the British-made plant will not be a charge upon the ratepayers, but will be borne by the electricity consumers in the shape of charges for energy. The undertaking is a prosperous and profitable one, and the ratepayers, as such, have not had any deficiency in revenue to meet out of the rates for the past 15 years, while in 1915 the rates were relieved out of the profits of the undertaking to the extent of £500. One of the most important considerations in the minds of the Committee in recommending the acceptance of the British tender was the difficulty which might be experienced in enforcing the guarantees under the contract in the event of a German tender being accepted and in replacing parts defective or worn after the expiration of the period of guarantee. The Committee's chief concern, it goes on to say, was and is to secure reliable plant which will enable the undertaking to work at the highest efficiency and to avoid risks, whether legal or engineering, the financial effect of which it found it difficult to estimate accurately or at all.

Ebonite Manufactures.—As an example of their work in ebonite, Messrs. Fuller's United Electric Works, Ltd., have sent us a neat desk calendar consisting of a square ebonite block with a sloping table bearing monthly date slips. A disk device makes the day of the month visible through a small opening in the base.

LIGHTING AND POWER NOTES.

Accrington.—Loan Sanctioned.—The Electricity Commissioners have sanctioned a loan of £80,000 in respect of the Accrington scheme of electricity extension. The Commissioners add that they will be prepared to consider the sanction of any further sum when the actual cost of the work intended has been ascertained.

Extension of Supply.—The Town Council will shortly supply electricity to Oswaldtwistle, the terms to be 5 per cent. higher than the charges in the town, to cover the additional cost incurred. Application is being made for the necessary authority.

Barnstaple.—Loan.—The Town Council has applied to the Electricity Commissioners for a loan of £2,341, for condensing plant at the electricity works.

Canada.—Hydro-Electric Expenditure.—Colonel Carmichael, Minister without Portfolio in the Ontario Cabinet, has resigned from the Hydro-Electric Power Commission because last year's estimates of the Commission have been exceeded by $14,000,000 (about £3,100,000). It is believed that Sir Adam Beck will cease to be chairman of the Commission and that a new body, more directly responsible to the Government than the present Commission, will be appointed.—*The Times.*

Continental.—France.—Extensive works are to be undertaken by the Compagnie Parisienne de Distribution d' Electricité in order to meet the growing demand for light and power in Paris, and for this purpose the generating plant is to be increased from 120,000 kW to 240,000 kW. Under the new agreement between the company and the City of Paris, the expenditure on new works is to be met by the flotation of a loan of 100,000,000 fr.

Sweden.—The Motala hydro-electric works, which belong to the State, have recently been brought into operation. Two turbo-generators of 8,400 kW have been installed, and with three sets of machines, the station will be able to supply 21,000 kW. The water-power of the Motala river between Vattern and Boren is used. The sum of 12,000,000 kr. was voted by the Riksdag for the extension of the works.

Russia.—The construction of the Kiseloff power station has commenced at Gubach, on the river Kosva. It is intended to supply the local coal industry with electricity. The output of the station will be 4,000 kW, and electrical energy will be distributed over a radius of 200 versts, within which are included the towns of Perm, Kuschur Unschole, Solikamsk, Kisel, and Tchusoff. Fifteen hundred men are engaged on the work and it is anticipated that the station will be in operation by November this year.

Conway.—Electricity Supply.—The Town Council has entered into an agreement with the North Wales Power Co. for a connecting cable to be carried across the suspension bridge. By this means the company will be able to supply electricity on either side of the river.

Croydon.—New Plant.—The Electricity Committee has decided to expend £27,400 on a new boiler and equipment, a new pump, and repairs to two towers.

Edenderry.—Electricity Supply.—The Lighting Committee has requested Mr. C. McGuinness, consulting engineer, to submit a scheme for lighting the town with electricity.

Glasgow.—Hire of Motors.—There is a proposal before the Corporation to inquire into the desirability of hiring out electric motors for manufacturing and industrial purposes. It is pointed out by those favouring the proposal that many firms, owing to the present shortage of money, are unable to purchase motors, and it is thought that if they had the opportunity of hiring the motors at a modified rate they would more readily adopt electricity for their works.

All-electric Houses.—The "all-electric" houses, which have been visited by 20,000 people in the last few weeks, will remain open to visitors for some time yet.

New Cable.—The Unemployment Grants Committee has approved of the Corporation's scheme for the laying of 23,040 yards of e.h.p. cable in connection with the transmission of electrical energy from the power station at Dalmarnock.

Great Sankey.—Electricity Supply.—With regard to the proposed supply of electricity to the district by the Warrington Corporation, a canvass is to be taken to ascertain the number of residents who would be prepared to use energy.

Helston.—Electricity Supply.—A scheme has been submitted to the Town Council by the Camborne and Redruth Electric Power Co. for a supply of electricity to the district, and a meeting is to be held to consider the proposal.

Jersey.—St. Helier.—The Assembly of Principals and Officers of St. Helier has adopted the municipal scheme for electric lighting, and the Mayor has been instructed to take the necessary steps to obtain a loan of £100,000 for carrying out the scheme.

Kirkburton (Yorks.).—Electricity Supply.—The District Council has decided to apply to the Yorkshire Electric Power Co. for the terms on which it would be prepared to supply electricity to the district.

Kirkcaldy.—Loan.—Correction.—We were misinformed as to the amount required for electricity purposes by the Council. We understand that the sum is much smaller than that given in our note on p. 265 in our issue of February 24th.

Liverpool.—Extension of Supply.—The City Council is applying to the Electricity Commissioners for a Special Order granting power to supply electricity to Bootle, Litherland, Waterloo—with Seaforth and Great Crosby.

Loan.—Application is to be made to the Electricity Commissioners for sanction to a loan of £200,000 for the erection of a sub-station, buildings, plant and equipment.

Morecambe.—Bulk Supply.—Application is being made to the Electricity Commissioners for a Special Order for power to supply electricity to Heysham. The Lancaster Corporation has been requested to apply for sanction to extend the generating station at Lancaster, so that a bulk supply can be given to the Morecambe Corporation.

Nantyglo and Blaina.—Bulk Supply.—At a recent meeting of the Council it was considered that the offer of the Ebbw Vale Co., to give a bulk supply of electricity at 2½d. per unit, was too high, and it was decided to bring the matter before the Electricity Commissioners.

Newark.—Electricity Supply.—The Town Council has considered the offers of the Lincoln Corporation and Messrs. Ransome & Marles, of Newark, to supply electricity to the town, but has decided that the schemes are not suitable. Mr. Wordingham, consulting engineer to the Council, has recommended that Newark should establish its own undertaking at an estimated cost of £140,250.

Okehampton.—Proposed Purchase of Undertaking.—Negotiations have been entered with Mr. G. K. Blatchford, proprietor of a private electricity works, with a view to the purchase of his undertaking.

Porthcawl.—Electricity Supply.—The U.D.C. has decided to proceed with the scheme for the electric lighting of the area, and a Provisional Order has been applied for. The estimated cost of installing electrical plant at the Council's gas works is £10,000.

Price Reductions.—Reductions are to be made in the charges for electricity in the following districts:—Canterbury, Fulham, Glasgow, Hampstead, Kingston-on-Thames, Leicester, Liverpool, Tonbridge, Tunbridge Wells, Weymouth, Barnstaple, and Dundee.

West Ham.—Electricity Supply.—Correction.—The report of the meeting of electricity consumers given in our last issue was incorrect in parts. A 10,000-kW set, and not a 20,000-kW set, is being installed. This will not replace, but will be in addition to the 5,000-kW generator. The Council has made a definite recommendation as to a price reduction, as the undertaking is now being run at a profit.

TRAMWAY AND RAILWAY NOTES.

Continental.—Italy.—A concession has been granted to Luigi Bruno, of Casaltore (Avellino), for the construction and working of a tramway from Mercogliano to the Santuario di Montevergine. The estimated cost of the undertaking, which is to be completed within two years, is 689,000 lire. The *concessionaire* may place orders abroad for equipment to the extent of half of the requirements.

The Società anonima Ferroviaria di Bitonto has been formed with a capital of 350,000 lire for the construction and working of an electric railway from Bitonto to S. Spirito. The estimated cost of the works and equipment is 1,451,241 lire. Electricity will be supplied by the Società Generale Pugliese.

Switzerland.—The Council of Administration has under consideration plans for the extension of the power station at Amsteg. The estimated cost of the extensions is 6,000,000 fr.

Hungary.—The scheme for the electrification of the State railways has been postponed owing to the present high cost of raw and finished material and political and economic conditions. The first locomotive was completed recently, and was to have had a trial run last month.

Hull.—Contribution for Rate Relief.—The Tramways Committee is contributing £10,000 from the tramways compensation account toward the relief of the rates.

India.—Bombay.—According to the *Railway Gazette*, an underground railway for Bombay, about 7.44 miles in length, has been suggested by the municipal special engineer. The total cost, with equipment, is estimated at Rs. 246 lakhs. The twin-tube system is recommended as cheaper than one tunnel for a double line.

London.—The L.C.C. has come to an agreement with the London United Tramways under which the L.C.C. cars will run from Tooting terminus to Wimbledon over the L.U.T. lines.

Post Office Tube Railway.—Extension of Time.—The Minister of Transport has extended the time of the Post Office (London) Railway Act, 1913, for the completion of the railway and works until August, 1923.

West Africa.—Railway Electrification.—The Government of French West Africa has had a scheme prepared for the electrification of the line from Kayes to the Niger. Certain waterfalls along the Senegal and the Niger have been surveyed in connection with the scheme. The contract for the works has been placed with the Société Générale d'Entreprise.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—Wireless Telegraphy.—A National Government Decree, dated January 9th, authorised the "Compania Siemens Schuckert, Ltd.," representing the "Telefunken" Co., of Berlin, to transfer the concession accorded to it on March 15th, 1919, to the "Transradio Compania Radiotelegrafica Argentina."—*Review of the River Plate.*

Germany.—Resuming Cable Traffic.—The German newspapers report that the German Atlantic and German South American telegraph companies have concluded an arrangement with the American telegraph companies whereby the German companies will be enabled to resume cable traffic. The German companies will be merged and afterwards issue shares trebling the capital. The German companies will work the Emden-Azores section, while the Azores-New York section will be worked in conjunction with the American concerns.—*Reuter's Trade Service* (Berlin).

Russia.—New Radio Station.—Work on the construction of the new radio-telegraph station at Dyetsky village is approaching completion. The old station was destroyed in 1919 in the Yudenitch advance. All that remained was the workmen's dwellings some distance from the station. A special railway branch was made to aid in the reconstruction which was begun in September, 1920. A new building for the machines, &c., and five 125-metre masts have been erected. The machines are nearly all installed. Siemens-Schuckert made the electrical machines and distributing apparatus; Siemens-Halske & Ericsson the radio-telegraphic parts; Nobels the Diesel motor; and the "Pharphorovni" concern the insulators.

Sweden.—Telegraph and Telephone Services.—The State telegraph and telephone services realised a net profit during 1921 of kr. 19,000,000. Total receipts amounted to kr. 99,500,000, out of which telephone subscriptions accounted for kr. 53,700,000. The net profit obtained by the General Post Office was kr. 10,400,000.—*Reuter's Trade Service* (Stockholm).

Magnetic Storm.—Magnetic disturbances of the atmosphere were noted throughout North-West Europe on February 22nd and 23rd. The electrical disturbances recorded by the Air Ministry's meteorological station at Croydon are said to have been strong.

The Telephone Service.—New Exchange.—An additional telephone exchange was opened within the boundaries of the City of London on March 4th. This new exchange, which is the twelfth to be opened in London within the last two years, is to be known as Bishopsgate, and is intended to serve an area embracing the thoroughfare of that name and extending to Whitechapel, Bethnal Green, and Haggerston. As it is situated within five miles of Oxford Circus, the central telephone measuring point, calls may be passed for 1½d. up to a distance of ten miles from Oxford Circus. It is proposed eventually to erect a special building for the Bishopsgate exchange, which will be one of the largest in London; but owing to the pressing needs of the neighbourhood and the necessity for affording early relief to the adjacent telephone areas of London Wall, Avenue, Bank, &c., the equipment is temporarily installed in the premises partly occupied by the recently-opened Clerkenwell exchange, which we have already described. At the opening on Saturday last, 726 subscribers in the new Bishopsgate exchange area and now working on other exchanges, were given service on the new equipment, and further additions will be made from time to time. The effect of the transfers will be to accelerate the work of joining up subscribers to the neighbouring exchanges, and to provide for development within the Bishopsgate area. A large amount of intricate work on the external cables has been involved in order to divert subscribers' circuits to the new exchange, and much remains to be done before it will be possible to join up subscribers freely in all parts of the area; but the work is being pushed forward as rapidly as possible.

City Breakdown.—A breakdown of the City telephone service occurred last week through the bursting of a water-main, which broke down the walls of a manhole and so affected the telephone cables. The area of the breakdown was between Electric House, Moorgate Street, and the General Post Office in Newgate Street, and something like 400 Post Office lines weer affected. Communication between the London Wall and Central exchanges was impossible for some hours.

United States.—Wireless Telephony.—Statistics published at New York show, says the *Daily Telegraph*, that the number of wireless telephone receivers in use has increased from 50,000 to 600,000 in a year. The country is plotted into circuits, and central stations distribute the "aerial goods" with regularity. As we recently announced, a conference is assembled at Washington to consider the "charting" of the air, so that all interests may obtain the maximum service with the minimum interference.

According to the *Daily Chronicle*, the former German liner, *Leviathan*, the largest ship afloat, after deteriorating in the Hudson river ever since she was placed out of commission as a troopship, is to be reconditioned at a cost of £1,600,000. Among other innovations will be a wireless telephone instrument in every first-class cabin. By this, through the ship's central apparatus, passengers will be able to communicate with friends ashore. The *Leviathan* will, it is expected, be put in the Transatlantic service next summer.

Wireless Control.—President Harding, upon the recommendation of the Radio Congress, now in session at Washington, has asked Congress for an appropriation to enable the Government to regulate the activities of wireless amateurs. The plan was to compel these amateurs to adopt shorter wave-lengths, which, it was thought, would not interfere with the longer wave-lengths of official communications. However, Genearl Squier, head of the Army Communications, announced that short waves would not bring about the desired harmony.—*Westminster Gazette.*

Wireless Telegraphy.—French Service Restored.—Marconi's Wireless Telegraph Co., Ltd., announced on March 2nd the restoration of the high-speed wireless service with France, which was affected by the recent flooding of an underground cable conduit in Cheapside. There is also no longer any delay on Marconigrams to North and South America, Australasia, Spain, &c.

Foreign Office Services to be Abandoned.—The Foreign Office News Department, which sends out a daily summary of British news by wireless to European countries, is to be closed owing to its cost, which amounts to £35,000 a year.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—April 29th. Electricity Commission. 22,000-V, three-core cable and accessories for the Morwell power scheme. (February 24th.)

Barrow-in-Furness.—Electricity Department. Electrical stores, meters, &c., for 12 months. Electrical engineer.

Belfast.—March 16th. Electricity Department. Six or 12 months' supply of stores, including many electrical items. (March 3rd.)

Belgium.—April 3rd. Limbourg Permanent Deputation, at Hasselt. Establishment of an electricity distribution system between Eysden, Rothem, and Maeseyck, between Rothem, Brée, and Caulille, and between Eysden and Reckheim. Specification from the Bureau du Service Provincial d'Electricité, 27, Avenue Bamps, Haselt.

March 15th. Belgian Ministry of National Defence. Supply of 12,500 metres of double-conductor insulated cable. Particulars from La 3me Direction Générale du Ministère de la Défense Nationale, 10, Rue du Méridien, Belgium.

March 17th. Secretariat General de l'Administration des Hospices et Secours of Brussels (Hôpital Saint-Jean, Boulevard Botanique). Supply of electric lamps to the various Brussels hospitals.

Blackpool.—March 16th. Electricity Committee. H.p. switchgear and switch-room equipment for power house and sub-stations. H.p. underground armoured three-core transmission cables. (February 24th.)

March 16th. Electricity Committee. One natural draught cooling tower. (March 3rd.)

Bristol.—March 17th. Docks Committee. Four 30-cwt. movable electric jib cranes. Mr. T. A. Peace, engineer, Bristol Docks Committee, Avonmouth Docks.

Bulgaria.—Sofia.—April 3rd. Direction of Posts and Telegraphs. Pole-line hardware, consisting of straight and bent supports for insulators, fixing clamps and yokes.*
April 21st. Telephone switchboards.*

Cardiff.—March 17th. Electricity Department. One 40,000-lb. water-tube boiler with mechanical stokers and accessories. (March 3rd.)

Cheadle & Gatley.—April 3rd. Urban District Council. E.h.p., m.p., and l.p. mains and street lighting accessories. (See this issue.)

Croydon.—March 27th. Electricity Department. Steam-raising plant, consisting of water-tube boiler, &c. (See this issue.)

Dundee.—March 22nd. Electricity Department. Circulating water pipe-line. Mr. H. Richardson, general manager and engineer.

Edinburgh.—March 13th. Tramways Committee. Rails for the Tramways Committee. The manager, 2, St. James' Square, Edinburgh.
April 15th. Electricity Department. Converting plant for lighting and traction, d.c. switchgear, for the Portobello station. (See this issue.)

London.—H.M. Office of Works.—April 12th. Supply of electrical engineering labour-in-daywork in the Leeds district. (March 3rd.)
L.C.C.—April 10th. Ash conveyor of the water-immersed, drag-link type, and ash hopper for the Greenwich power station. (See this issue.)
Hampstead.—March 15th. Electricity Department. Six or 12 months' supply of electrical engineering stores, oils for the electricity station. For removal of ashes and coal-handling, both for periods of 6 months. (See this issue.)

Leeds.—March 13th. Education Committee. Repairs, including electrical work, required to school buildings during 12 months ending March 31st, 1923. Mr. J. Graham, Director of Education, Education Offices, Calverley Street.

Rhondda.—April 3rd. Electricity Department. Supply of house service a.c. meters, cable, joint boxes, compound, cut-outs, &c., for 12 months. (February 24th.)

Salford.—Tramways Department. General supplies for six months. General manager, 32, Blackfriars Street, Salford.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Burton-on-Trent.—Electricity Committee. Accepted:—
6,000-kW turbo-generator (£32,150); feed-water heater (£700); stand-by extraction pump (£870).—C. A. Parsons & Co.
Switchgear (£1,750); earthing equipment, with cables and a bus-bar coupler equipment (£1,920).—Metropolitan-Vickers Electrical Co.
Boilers (£40,180); ash-handling plant (£1,156).—Babcock & Wilcox, Ltd.

Glasgow.—Electricity Committee.
Five sets of rotary-converters, transformers, and switchboards, for Bridgeton, Langside, and Alexandra Parade sub-stations (recommended).—British Thomson-Houston Co., Ltd., £36,283 for the rotary-converters and transformers.
Ferguson Pailin, Ltd. (£2,422), switchboards.

Tramways Committee. Recommended:—
Insulated bolts.—British Insulated & Helsby Cables, Ltd.

Gloucester.—City Council. Accepted:—
Additional plant for the electricity works.—Two 1,500-kW geared turbo-generators, with condensing plant by Cole, Marchent & Morley, £22,414, English Electric Co., Ltd.

Liverpool.—Electric Power and Lighting Committee. Recommended:—
Four 1,500-kW rotary-converters, complete with switchgear, accessories, and spare transformer, &c.—Metropolitan-Vickers Electrical Co., Ltd.
Installation at the Charters Street destructor station, 500-kW generating set.—Belliss & Morcom, Ltd.
Installation of an auto-rotary equipment at the Walton Town Hall.—Metropolitan-Vickers Electrical Co., Ltd.
Cables and accessories to the Liverpool Electric Supply Department and other departments of the Liverpool Corporation, for the 12 months ending March, 1923 (recommended).—Callender's Cable & Construction Co., Ltd.

Worthing.—Town Council. Accepted:—
Motor generator (£324).—General Electric Co., Ltd.

York.—Electricity Committee. Accepted:—
Meters.—A.E.G., of Berlin.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, March 10th. In the Great Hall, Cannon Street Hotel, E.C. At 8 p.m. Smoking concert (the last of the season).

Electrical Power Engineers' Association (Midland Division).—Saturday, March 11th. At the Imperial Hotel, Birmingham. At 7 p.m. First annual dinner.

Salford Technical and Engineering Association.—Saturday, March 11th. At the Royal Technical College. At 7 p.m. Paper on "From Factory to Face, or the History of a Colliery Cable," by Mr. W. T. Anderson.

Royal Institution of Great Britain.—Saturdays, March 11th and 18th. At Albemarle Street, W. At 3 p.m. Lectures on "Radio-activity," by Sir Ernest Rutherford, F.R.S.

Birmingham and District Electric Club.—Saturday, March 11th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Ball Bearings," by Mr. A. Macaulay.

Institution of Electrical Engineers.—Thursday, March 16th. At the Institution, Victoria Embankment, S.W. At 6 p.m. Paper on "Phantom Telephone Circuits and Combined Telegraph and Telephone Circuits Worked at Audio Frequencies," by Mr. J. G. Hill.

(North-Midland Centre).—Tuesday, March 14th. At the Hotel Metropole, Leeds. At 7 p.m. Ordinary meeting.

(Scottish Centre).—Tuesday, March 14th. At the North British Station Hotel, Edinburgh. At 7 p.m. Paper on "Telephone Line Work in the United States," by Mr. E. S. Byng.

(South-Midland Centre).—Wednesday, March 15th. At the University, Birmingham. At 7 p.m. Paper on "Electric Motor Starters," by Mr. J. Anderson.

(Sheffield Sub-Centre).—Wednesday, March 15th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper, "Notes on the Practical Operation of e.h.p. Protective Gear," by Mr. F. Langley.

(North-Eastern Centre).—Monday, March 13th. At the Armstrong College, Newcastle-on-Tyne. At 7.30 p.m. Address by the President, Mr. J. S. Highfield, on "The Primary and Secondary Education of Engineers."

(Dundee Sub-Centre).—Monday, March 13th. At the University College, Dundee. At 7.30 p.m. Papers on "Electric Motor Starters," by Mr. J. Anderson, and on "Induction-type Synchronous Motors," by Mr. L. H. A. Carr.

(North-Western Students' Centre).—Tuesday, March 14th. At the Houldsworth Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "Commutation, Armature Reaction, and the Selection of Carbon Brushes for Dynamo-electric Machinery," by Mr. J. W. A. Abernethy.

National Association of Supervising Electricians.—Tuesday, March 14th. At St. Bride's Institute, E.C. At 6.45 p.m. Paper on "The Determination of Heat Losses From Buildings, with Special Reference to Electrical Heating," by Mr. W. T. Nobbs.

Women's Engineering Society.—Tuesday, March 14th. At 26, George Street, Hanover Square, W. At 6.15 p.m. Lecture on "Women's Place in Industry," by Mr. F. S. Button.

Institution of Civil Engineers (Students' Meeting).—Wednesday, March 15th. At the Institution, Great George Street, S.W. At 6 p.m. Vernon Harcourt lecture on "The Great Ship-Canals of the World," by Mr. G. Fitzgibbon.

Northampton Engineering College Engineering Society.—Wednesday, March 15th. At the Northampton Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Developments in Aeroplane Design," by Mr. R. H. Walmsley.

Paisley Association of Engineers.—Wednesday, March 15th. At the Y.M.C.A. Buildings, High Street. At 7.30 p.m. Business meeting (the paper awarded the second prize will be read).

Ideal Home Exhibition, Olympia, W.—Wednesday, March 15th. At 7 p.m. Lecture on "The Modern Use of Electricity in the Home," by Mr. S. J. Harding.

Industrial League and Council.—Wednesday, March 15th. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "Psychology in Industry," by Mr. W. Piercey.

Chemical Society.—Thursday, March 16th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary meeting.

Belfast Association of Engineers.—Thursday, March 16th. At the Municipal College of Technology. Paper on "Water Power," by Mr. G. Fletcher.

Chelmsford Engineering Society.—Friday, March 17th. At the East Anglian Institute of Agriculture. At 7 p.m. Conversazione.

Junior Institution of Engineers.—Friday, March 17th. At Caxton Hall, S.W. At 8 p.m. Lecturette on "Power Factor Improvement," by Mr. G. H. Ayres.

British Electrical Development Association.—Friday, March 17th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7.30 p.m. Conference on "Salesmanship in Relation to Showroom Displays and Demonstrations," to be opened by Mr. A. C. Bostel.

London Electrical Engineers: No. 4 (Newhaven Company).—Saturday, March 18th. At Anderton's Hotel, Fleet Street, E.C. At 6.30 p.m. Annual dinner.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of:—

Manufacturers and Repairers of Condensers for High Frequency Machines (London district preferred).

NOTES.

The Dispute in the Engineering Trade.—On Sunday, in a speech at Rugby, Mr. J. T. Brownlie, the president of the Amalgamated Engineering Union, appealed for the intervention of the Prime Minister, with the object of bringing together the parties to the dispute in the engineering trade, to which we referred at length in our leading article last week. The notices for the lock-out are due to expire to-morrow, Saturday. On Monday the executive of the A.E.U. and the National Divisional Organisers held a conference lasting for three hours, and according to a statement issued at night by Mr. Brownlie, a communication was received during the discussion, from Dr. Macnamara, the Minister of Labour, on behalf of the Prime Minister, who is indisposed. Dr. Macnamara invited Union representatives to meet him on Tuesday. The meeting with the Union Executive took place on the morning of that day and the Minister of Labour met the employers in the afternoon. The Union Executive met the engineering employers on Wednesday in the hope that negotiations with regard to the dispute might be re-opened.

As we go to press we learn that the negotiations between the Engineering Employers' Federation and the A.E.U. broke

down. Statements were issued by both sides relating to new proposals which had been under discussion. The employers were unable to accept proposals submitted by the Unions relating to the general principles of management, they being diametrically opposed to what were agreed upon in November, 1921. It was stated that the question of overtime and other questions of detail were not reached, the time being spent in discussing the fundamental principle at issue. The result of the proceedings was reported to the Minister of Labour, and it was stated that the A.E.U. would yesterday confer with the representatives of the Federation of Engineering and Shipbuilding Unions.

Appointments Vacant.—Assistant engineer (£450), for the Government of British Guiana Post Office Electrical Department; attendant for the electrical equipment on the Chester-le-Street Housing Estate; chief electrical engineer for the Rangoon Electric Tramway & Supply Co., Ltd.; draughtsman for the Stepney Borough Council Electricity Department; two male clerks (70s. and 60s.), for the Chesterfield Corporation Electric Tramway and Motor Bus Departments. (See our advertisement pages to-day.)

Industrial Research.—To further the objects of the British Non-Ferrous Metals Research Association an important meeting was held in Birmingham on Friday last. Mr. T. Bolton presided, pointing out that the importance of research to industry had been fully recognised by the Government; that the Department of Scientific and Industrial Research, which made grants to trade research associations, had escaped the "Geddes Axe" was a splendid testimonial to its efficiency, and also the strongest evidence of the recognised value of the work such associations were doing. Vice-Admiral Sir Geo. Goodwin (engineer-in-chief to the Admiralty) urged the claims of the Association, and Dr. Rosenhain (Metallurgical Department, National Physical Laboratory), pointed out that such associations would help to bring about immediate utilisation of the results of the researches when they were obtained. Sir Frank Heath (secretary of the Department of Scientific and Industrial Research) urged that while the Geddes Committee could not recommend any reduction of the financial provision at his disposal, his impression was that the financial difficulties of the Government were not ended. Mr. Bolton pointed out that the Association desired to initiate for the benefit of members as many researches as its finances permitted. As the Association possessed no laboratories of its own, investigations were being undertaken in the national and university laboratories. He added that considerable information was being collected with a view to commencing an important research relating to various methods of jointing metals, soldering, gas and electric welding, brazing, &c., including the alloys and methods of heating employed, and the strength, permanence, conductivity, &c. of the resultant joints. Arrangements had been made to commence this investigation in the Research Department of the Metropolitan-Vickers Electrical Co., Ltd., Manchester, where the necessary supplies and skilled labour required for making joints and the machinery for testing them were available. The financial support for this research took the form of payment by the Association of the salary of the research worker, the whole of the materials and other labour being supplied by the Metropolitan-Vickers Co.

The I.E.E. Commemoration Meetings.—We have been asked whether it would be possible to supply art proofs of the portraits which we reproduced in our articles on the commemoration meetings of the Institution of Electrical Engineers, so that they could be mounted and framed. It will be possible to do this, at a price not exceeding 2s. 6d. a set (13 portraits), if a sufficient number of applications are received. We shall be glad to hear from readers who are interested.

Railway Electrification.—A meeting of the Industrial Group at the House of Commons recently, Sir Allan Smith presiding over an attendance of 26 M.P.s, considered the appropriate steps to be taken to facilitate the immediate electrification of the London, Brighton and South Coast Railway, thereby providing employment for a very large number of people and securing the placing of contracts for several millions of pounds. After a long discussion, in which Colonel Cuthbert James, Sir Philip Dawson, Sir William Pearce, Sir Arthur Shirley Benn, Major Glyn and Mr. Hannon took part, it was unanimously agreed to appoint a deputation to meet the Parliamentary Secretary of the Ministry of Transport to place before him the whole of the facts which had been brought forward during the discussions at two recent meetings of the group, and to invite his assistance in suggesting such amendments to the Railways Act as would enable the Brighton Co. to proceed without delay with the scheme. The deputation was to consist of Sir Allan Smith, Sir William Pearce, Sir Philip Dawson and Mr. Hannon.—*Financial Times.*

Educational.—In connection with the development of mining engineering studentships under the Glamorgan County Education Committee's auspices, a fully-equipped laboratory has been opened at Pontypridd. The plant includes models of all the electrical, gas, and steam machinery used at collieries for pumping, ventilation, and lighting. In the county there are some 30,000 students receiving technical instruction, the majority being part-timers.

National Association of Supervising Electricians.—The Association held its annual general meeting on February 14th at the St. Bride's Institute, E.C.4, when Mr. F. W. Smith, the chairman of the Association, presided over a well-attended gathering.

The Chairman, in his address, complimented the members on the improved position of the Association, and gave a brief résumé of the Association's activities. The appointment of a full-time general secretary was a courageous move on the part of the Board of Control, but he was pleased to say the action had been fully justified. The finances of the Association were sound, new members were continually being received, and the general position was better than it had ever been. Inquiries were being received from all parts of the country, and the formation of district branches was well in hand. The necessity for the Association in the electrical industry had been fully demonstrated and its educational work had been of great benefit to those concerned. It was necessary that they should safeguard the interests of the members and see that the workers got an adequate return for their labour. The agreement with the National Federated Electrical Association was a step in the right direction, and prepared the way for greater advancement.

The General Secretary (Mr. A. Brammer) presented the annual report and accounts, which showed a greatly improved state of affairs. Mr. E. E. Gammon (the hon. Treasurer) moved the adoption of the accounts.

The ballot for the declared vacancies on the Board of Control resulted in the following being elected: Messrs. F. J. Alldread, C. Burrows, J. F. Chapman, P. N. Hindell, J. Hudson, H. Manning, S. Nicholls, T. E. Pinder, F. W. Smith, A. Tucker, S. Smith, R. W. Whitley, T. H. Windibank, and C. G. Wright. Messrs. E. Rooke and J. H. Hall were elected as members' auditors. The affiliation to the National Federation of Professional, Technical, Administrative, and Supervisory Workers is to be continued, and the social side of the Association is to be further developed.

A paper is to be read on March 14th, at the St. Bride's Institute, E.C.4, by Mr. W. W. Nobbs, Past. Pres. I.H.V.E., M.I.Mech.E., &c., of Messrs. Geo. Nobbs, Ltd., on "The Determination of Heat Loss from Buildings, with Special Reference to Electrical Heating." Tickets may be had on application, but early requests are desired in view of the limited number being issued.

Scientific Congress in Belgium.—The Association des Ingénieurs sortis de l'Ecole de Liége is organising an international scientific congress, to be held on the occasion of the 75th anniversary of the foundation of that institution. The congress will comprise seven sections: mines, metallurgy, mechanics, electricity, industrial chemistry, civil engineering and geology. Electricity will be divided into 24 sub-divisions: turbo-alternators, large generating stations, hydro-electric stations, transmission at over 100,000 volts, material needed for the same, district distribution, protection of high-pressure lines, making of the highest-pressure underground cable, automatic sub-stations, mercury vapour converters, improvement of the power factor of networks, railway electrification, commutator polyphase motors, regulation of the speed of rolling-mill motors, electric drive on shipboard, aluminium, electricity tariffs, electric lamp construction and use, electric heating, heat-accumulators, automatic telephony, wireless telegraphy and telephony, radiogoniometry, and electric dust precipitators.

The programme will commence on Sunday, June 11th, with the unveiling of a memorial to the members who fell in the war, followed by a reception, the opening of the exhibition, and a banquet. On the following day the Congress will commence, and the sittings will continue until June 14th, after which visits to works and to the exhibition, and excursions will take place. Receptions, soirées, &c., will be held throughout the week, and the Congress will close with a farewell re-union on Friday, June 16th. The exhibition will remain open until Friday, July 14th, when a Franco-Belgian déjeuner will be held.

The transactions of the Congress will be published at the price of 100 fr., but part of them will appear in the *Revue Universelle des Mines* from April, 1922, to June, 1923, and subscribers to the *Revue* will receive the transactions at the reduced price of 50 fr. Admission to the Congress alone costs 25 fr.; to the Congress and all the fêtes, 125 fr.; the subscriptions to the transactions are additional to these amounts. A Housing Committee will function throughout the period of the fêtes, and visitors should make application to it before May 31st, while subscriptions should be sent to the Association des Ingénieurs, Quai des Etats-Unis, 16, Liége, not later than May 15th. Full information regarding the subjects to be discussed at the Congress and all other matters can be obtained from the secretary at that address. The programme, &c., may be seen at the office of the Electrical Review.

E.S.C.A. Bohemian Concert.—A very enjoyable evening was spent by a large gathering of members of the Greater London Division of the Electricity Supply Commercial Association and their friends, on March 1st. The occasion was the second Bohemian concert which took place at Anderton's Hotel, Fleet Street. Mr. D. C. Clark, of the London Divisional Council, was in the chair, and an excellent and varied programme was presented by a number of artistes.

There was not a dull moment, every item being equally enthusiastically received. The vocalists were Miss Doris Cowan (soprano), Mr. Edward Bennett (tenor), and Mr. Robert Mulvey (baritone). Humorous items were contributed to the programme by Miss Dorrie Dene and Messrs. Frank Beck and Hector Gordon. Miss Dorrie Courtney rendered some splendid banjo solos, and Miss Evelyn Baly acted as accompanist.

The International Conference on H.P. Transmission Systems.—The Central Office of the I.E.C. informs us that the verbatim report of the Conference on High-pressure Transmission Systems held in Paris last November will be published next month, in French and in English, by the Union des Syndicats de l'Electricité. It will be remembered that this Conference was arranged by the Union with the object of discussing technical questions relating to the construction and working of high-pressure transmission lines. The price of the report will be 60 fr. if ordered before April 1st, or at least 75 fr. if ordered after that date. The Union would be glad if those who wish to procure the report would inform M. Tribot Laspierre, General Secretary of the Union, Boulevard Malesherbes 25, Paris, with regard to the number of copies required, specifying whether they are to be in French or English.

The Wimbledon Case.—At a meeting of the Wimbledon Borough Council, on March 1st, the chairman of the Electricity Committee stated that, having been pressed for a reason for Mr. Tomlinson-Lee's dismissal, he would state that it was because they had "lost confidence" in him. After some discussion it was decided to appoint a new engineer. A further public meeting of protest against the Council's action was held the same evening. At another Council meeting on March 6th the matter was again raised.

Submarine Telegraph Cables.—At the Camera Club, on March 2nd, a lecture on "Submarine Telegraph Cables," illustrated by unique lantern slides, was delivered by Mr. E. B. Bothwell, of the Central Telegraph Office. He commenced with a description of the earliest stages of laying telegraph cables, when a length was laid between Folkestone and a ship two miles out from the shore. This was followed by attempts to connect Dover with the French coast. He next referred to the endeavours to bring the United States and Great Britain into closer communication, between 1858 and 1866, and then to the laying of two cables between Valentia and New York. Reference was made to the success achieved during the recent war in maintaining communication between England and Canada *via* the Azores. In order to continue the connection, slides were introduced depicting the route between Halifax, Nova Scotia and Bamfield, Vancouver Island, and thence *via* the longest cable in the world, between Bamfield and Fanning Island in Mid-Pacific, to Australia and New Zealand.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Informal Meeting.—With Mr. E. W. Moss in the chair, Mr. E. F. Hetherington (North Metropolitan Electric Supply Co.), held the interest of the informal meeting on February 20th in opening a discussion on "The Emergency Use of Oil during the Coal Strike." Exhibits of the principal makes of oil burners were examined by the members at the close of the meeting.

Mr. Hetherington described his experiences with an extemporised oil-burning equipment on two 15,000-lb. per hour boilers, from which the 7-ft. chain grate stokers were removed, the ash pits being floored with broken firebricks and ashes, to form part of the combustion chamber. The oil was heated by a steam heater connected to the range, with outlet piped to the feed-water heater; by means of wide-scale thermometers, the firemen kept the oil temperature between 170 and 180 deg. F. The boilers were worked for three months at full capacity for 24 hours without tube trouble of any kind. The human element proved a difficulty because the firemen supplied an excess of oil when steam was low; it was made clear that the correct proportions of oil and air gave the best results. It was found that oil provided a greater scope for waste than coal. The respective calorific values of oil and coal were considered; no more than 10 per cent. of CO_2 could be obtained when combustion was complete, owing to the high percentage of aqueous vapour in the exit gases, due to hydrogen in the oil.

Emergency oil-firing installations had not shown a very high efficiency, and central station men, on that account, were disinclined to talk about results. With a complete new job, oil offered advantages, both in capital outlay and labour charges. Comparison of oil at 85s. per ton with coal at 30s. showed that the cost of evaporating 1,000 lb. of water was 75 per cent. greater with oil; for the latter to compete with coal, its price would need to be 50s. per ton. If the boilers were to be worked continuously, oil at present was not a paying proposition. In a station with a purely lighting load, where peaks might occur, oil firing would show to great advantage, but in a station with a good running load factor the installation of oil firing might not be worth while.

In the discussion Mr. J. R. Bowden (Hackney) detailed his experience in the equipment of four 10,000 and two 12,000-lb. boilers for oil firing. There were no steaming troubles, but the firebrick was a great difficulty; 14 per cent. CO_2 could be maintained as an average. The capital cost for six boilers with a 50-ton storage tank, pumping plant, and pressure equivalent, was £2,500. The installation was now permanent, and operated in conjunction with a coal-fired boiler house; it was always possible to raise steam in a few minutes in an oil-fired boiler which had been shut down a number of hours.

Several speakers referred to firebrick troubles, and Mr. L. M. Jokel suggested the use of carborundum. Mr. Nevill Huntley explained the difficulties of ascertaining the net calorific value of fuel oils. Mr. R. J. Lappin explained that the success of oil firing in the Navy was due to the mounting of the fire bricks in the form of tiles and in a way which allowed ample freedom for movement during expansion.

Other contributors to the discussion were Messrs. W. J. Marshal (Scarab Burner Co.), C. L. Lipman, J. Coxon, E. A. Scarborough, A. G. Hilling, and H. L. Critchley. The meeting was one of the most interesting held during the session.

North-Western Centre.—As announced in our last issue, the above Centre of the Institution has extended its area; the Centre has agreed to allocate the new area to its Liverpool Sub-Centre. The total membership of the Centre is now 438; the annual general meeting of the Centre will be held on May 8th, and will be followed by a smoking concert.

List of Members.—A new list of members of the Institution of Electrical Engineers has just been published. Members desirous of having a copy can obtain one on application to the Secretary.

Scottish Centre.—For the first time since 1913 members of the Scottish Centre of the Institution met at dinner in Glasgow on February 28th, and in view of the commemoration of the foundation of the Institution the festivities were in the nature of a jubilee celebration.

Mr. E. T. Goslin, chairman of the Centre, and general manager of the Clyde Valley Power Co., presided, and the Council of the Institution was represented by Professor E. W. Marchant, Liverpool, one of the vice-presidents.

Sir F. C. Gardiner, in proposing the toast of the Corporation, said the Electricity Department and the company of which he was chairman (the Clyde Valley Electrical Power Co.) and other concerns represented there were interested at the present time in the problem of the electricity district. He congratulated the Corporation upon the convening of a meeting on the previous day to consider that matter, and he felt confident the West of Scotland would show itself capable of a friendly and appropriate accommodation in the matter, and that it would not be necessary to wait till the autocrats of the electricity switchboard in London came down to adjust things for them. He was not afraid of their friends, Mr. Lackie and Mr. Page, but he confessed that he would regard it, if not a disgrace, at all events a slur upon their character as business men and as patriotic citizens if they failed to reach a reasonable and friendly adjustment of that difficult problem.

Bailie Paterson, in reply, pointed out that if the Subway Railway were acquired by the Corporation, the chances were that it would be electrified.

Sir Thomas Dunlop, Bart., proposed "The Institution of Electrical Engineers," and spoke of the marvellous progress made by electricity in the 50 years since the Society was formed. As to the future, there were great potentialities; electricity was still in its infancy.

Professor Marchant, who replied, said that it was 50 years to a day since the Society was formed. The granting of that charter had turned what was a private association into a national institution which could not be dissolved without the consent of the Privy Council. This distinction added to the prestige of electrical engineering, but that prestige had to be maintained primarily by the energy and skill of the members.

Professor Magnus MacLean proposed "The Guests." Sir James H. Kemnal, in replying, took an optimistic view of the future of the electrical engineering industry, based on the readiness with which the public subscribed capital for industrial undertakings. He mentioned that recently a company with which he was connected applied for about half-a-million to the public. The subscription list was closed in 25 minutes, and the amount applied for was 20 millions.

New By-laws.—Special general meetings of the Corporate Members will be held on March 23rd to consider proposed alterations in the by-laws, and to transfer to the Chartered Institution certain liabilities of the old Institution.

Institute of Marine Engineers.—Arrangements have been made to hold a conversazione and dance on April 21st, 1922, at the Hotel Victoria, Northumberland Avenue, W.C. Tickets, 15s. each, may be booked at once by members, and it is open to them to invite their friends. Applications should reach the Institute not later than April 17th. The programme will be arranged on somewhat similar lines to that of last year, and the proceedings will commence with a reception by the President and Lady Maclay at 6.30 p.m.

Electrical Power Engineers' Association (Derby and District Section).—A paper on "Power Station Efficiency" will be read by Mr. J. N. Waite on Thursday, March 23rd, at the Flying Horse Hotel, Poultry, Nottingham, on 6.45 p.m.

The Optical Society.—The twenty-third annual report shows a total membership in all classes of 340, being a net decrease of 24 during the year. The accounts are satisfactory, owing principally to the increased subscription rates. The income amounted to £893 and the expenditure to £665, leaving a credit balance of £228.

Institute of Metals.—The annual general meeting was held at the Institution of Mechanical Engineers on March 8th and 9th, when a number of papers were submitted, including "Notes on the Corrosion and Protection of Condenser Tubes," by Dr. G. D. Bengough, M.A.; and "Further Studies in Season-cracking and its Prevention—Boiler Tubes," by Messrs. H. Moore, O.B.E., and S. Beckinsdale, B.Sc. The annual dinner was held at the Trocadero Restaurant on March 8th, and the company included many distinguished members and guests. The annual report, which was submitted on the first day, showed an increase of members from 1,298 to 1,410. The receipts totalled £5,538, and the expenditure £5,131, leaving a balance of £407. The Corrosion Research Committee showed a credit balance of £2,225.

Institution of Railway Signal Engineers.—The following officers have been elected to serve during the 1922 session:—*President*, Mr. W. C. Acfield, O.B.E.; *Vice-President*, Mr. R. J. Insell; *Hon. Treasurer*, Mr. A. E. Tattersall; *Hon. Secretary*, Mr. G. Tweedie.

Birmingham Electric Club.—At the annual dinner on February 24th, Mr. Gilbert C. Vyle (Messrs. Avery's) referred to the difficulties of the industrial position, and stated that the cost of production, which, he thought, rested at the door of Labour, and nowhere else, affected the situation seriously. Mr. H. K. Beale, chairman Birmingham Electric Supply Committee, stated that in 1895 half-a-million units of electricity were generated as compared with 137 millions last year. By the time the Committee had developed all its schemes, Birmingham would, he thought, be the largest generating authority in the country. Developments were about to take place on the eastern side of the city. With a bigger output it might be possible to reduce charges.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

At its last meeting the Barrow Electricity Committee recommended that the salary of the Borough Electrical Engineer (Mr. H. R. Burnett) be increased to £800 per annum, as from January 1st last, rising by two annual increments of £50, to £900 per annum, and that the bonus be discontinued. When the matter came before the General Purposes Committee, along with applications of other chief officials, it was decided that no alteration be made in the existing salaries and bonuses until January next, and the Corporation has adopted this course. In his letter to the Committee Mr. Burnett pointed out that his present salary was 24 per cent. in excess of the pre-war salary. The present salaries of the technical and clerical staffs were approximately 170 per cent., and the wages of the workmen 150 per cent. in excess of the 1914 salaries and wages. The average salary paid in 21 towns from which the Town Clerk obtained particulars in accordance with instructions was £876 per annum, as compared with an average salary of £525 paid in the same towns in 1914—an increase of 66 per cent.

Mr. F. Raylton Hodges, late sales manager of Messrs. T. B. Morley & Co., Hull, has commenced business as the Yorkshire Electric Supplies (wholesale only), Clarendon House, Clarendon Street, Hull, and wishes to receive manufacturers' catalogues and terms.

Upon leaving the A. & A. Electrical Co., Ltd., to take up his position with the London Factors & Agents, Ltd., Mr. F. M. West received a presentation from the staff of a marble inkstand and set of pipes.

Mr. Charles I. Baker, traffic superintendent and chief executive officer of the Blackpool Corporation tramways, has been appointed general manager of the Ashton-under-Lyne tramways, in succession to the late Mr. Ernest Holt.

The Times states that Major Robert Mitchell is retiring from his post as Director of Education of the Polytechnic, Regent Street, in July.

Tonbridge Urban Council has appointed Mr. F. Springate, installation inspector, as assistant engineer at the electricity works, in succession to Mr. E. G. Staygle, who has been appointed assistant engineer at Worthing.

Mr. Alexander Spencer has been appointed vice-chairman of the Metropolitan-Vickers Electrical Co., Ltd., in succession to the late Sir Francis Barker.

Mr. H. Rowe (of H. Rowe & Co., electrical engineers and importers, Melbourne, Victoria) is due to arrive in England on April 22nd by the R.M.S. *Narkunda*. He wishes to get into touch with manufacturers of electrical and other goods with a view to agency arrangements in Australia.

Obituary.—Mr. R. B. Slacke.—Randal Beresford Slacke, whose tragic death on the hunting field was referred to in our last issue, was born in 1876, the son of Sir Owen Randal Slacke. He received his early technical training at the Central Technical College, and in 1897 was articled to Mr. E. W. Cowan. The first year of his course was spent in the Ediswan Co.'s works at Broadheath, followed by shorter periods at Cowans, Ltd., Browett, Lindley & Co., and the Blackburn electricity supply works. After a few years' experience in electric light and power installation work at Blackburn in 1904 he joined the Key Engineering Co., Ltd., as director and joint manager of that company's Manchester office. In this capacity he became interested in the development of large gas engines, and in 1907, and again in 1908, he assisted in conducting parties of British engineers on a tour of inspection round some of the Continental works where large gas engines were to be seen in successful operation. In 1909 he took some of Messrs. Galloway's directors over much of the same ground, which eventually led to that firm's taking up the manufacture of large gas engines in this country. In 1910 he resigned his position of manager of the Key Enginering Co., whilst retaining his directorship of this company, to act as London manager of Messrs. Galloways, Ltd., and later in the same year he visited South America on a tour of inspection on their behalf. Upon the outbreak of war he enrolled as a Derby recruit, and as an old Volunteer did some very useful work in training men for active service. At the same time he was also engaged on anti-aircraft searchlights, and later he gave valuable voluntary assistance to the engineering staff of the Metropolitan Munitions Committee. He resigned his appointment with Messrs. Galloways in 1917 to accept a commission in the Royal Engineers, and after working for a short time at the Department of Inland Waterways and Docks he was lent by the War Office to the Admiralty as Assistant Director of Materials and Priority. Shortly after the armistice he joined the staff of *The Engineer* as manager, which position, together with his directorship of the Key Engineering Co., he retained until his death. He was a keen sportsman, yachting and hunting being his favourite pastimes. A friend, who has been intimately associated with him for many years, says: "Slacke was one of the most lovable personalities I have ever known; during the eighteen years we have worked together I do not remember ever to have seen any departure from the good-natured and ever cheery, calm and confident disposition which so endeared him to all with whom he came in contact. He was always ready to listen to any new proposition or business scheme, and displayed remarkable ability in reducing such proposals to their practical dimensions—so much so that his colleagues learnt to attach great weight to his views, realising that without any pessimism in his character, he could divest a proposition of all exaggeration without displaying fear of facing the legitimate risks which must accompany every new effort." All of his many friends, whilst lamenting their own loss, will sympathise most deeply with Mrs. Slacke and his son and daughter in their bereavement.

Mr. J. J. Wright.—The Canadian *Electrical News* records the death, at the age of 72 years, of Mr. J. J. Wright, a pioneer of the Canadian electrical industry, who constructed the first Canadian-made electric generator (25 h.p.), in a little back room in Toronto in 1881. He and Van Depoele jointly exhibited the first Canadian electric railway system at the annual Toronto Exhibition in 1883.

Mr. James Marshall.—We regret to record the death, which occurred at his residence at Gainsborough, on February 27th, in his 86th year, of Mr. James Marshall, chairman and managing director of Messrs. Marshall, Sons & Co., Ltd.

Alderman E. H. Sellers.—The death occurred, on March 1st, at the age of 68, of Alderman Ernest Herbert Sellers, chairman of the Huddersfield Corporation Tramways Committee.

Will.—The late Mr. W. G. Cowlishaw, of Basford, Stoke-on-Trent, whose name is prominently associated with coal-cutters, left £27,101.

NEW COMPANIES REGISTERED.

Bombay Electric Supply & Tramways Co., Ltd.—Particulars of the Bombay Electric Supply and Tramways Co., Ltd., have been filed pursuant to Section 274 of the Companies (Consolidation) Act. The capital is Rs. 39,000,000 in 600,000 ordinary and 180,000 preference shares of Rs. 50 each. The company was incorporated in India on October 1st, 1920, to acquire the undertaking and all or any of the assets and liabilities of the Bombay Electric Supply and Tramways Co., Ltd., incorporated in England in 1905, including the benefit of a deed of concession dated August 7th, 1905, between the Municipal Corporation of the City of Bombay of the first part, W. D. Sheppard (Municipal Commissioner for City of Bombay) of the second part, the Brush Electrical Engineering Co., Ltd., of the third part, and the Bombay Electric Supply and Tramways Co., Ltd., of the fourth part; to acquire certain licences granted to the Brush Electrical Engineering Co., Ltd., and the Bombay Electric Supply and Tramways Co., Ltd., &c. The British address is 3-4, Clement's Inn, Strand, W.C.2, where F. C. Austen (London secretary) is authorised to accept service of process and notices on behalf of the company. The directors at date of incorporation were: Sir Sassoon David, Bart., Sir Fizulbhoy Currimbhoy, C.B.E., F. E. Dinshaw, A. H. Froom, Chunilal V. Mehta, Sir Stanley Reed, K.B.E., F. C. Remington, and R. D. Tata. The file number is 2,074F.

Guaranteed, Ltd. (179,993).—Private company. Registered February 28th. Capital, £100 in £1 shares. To carry on the business of electrical manufacturers, supply agents, and wholesale factors, electrical engineers and contractors, manufacturers of and dealers in electric and other apparatus, &c. The permanent directors are: C. Seymour, 295, Kingston Road, Wimbledon, S.W. (electric lamp factor); H. Feneron, 7, Moreton Place, Belgrave Road, S.W.1 (electrical sales manager). Qualification, £1. Registered office, 1 and 3, Sun Street, Finsbury Square, E.C.

Southall Engineering Co., Ltd. (180,058).—Private company. Registered March 2nd. Capital, £3,000 in £1 shares. To adopt an agreement with A. Bailey, J. C. Weber, and E. J. Selby, and to carry on the business of manufacturing, mechanical, and electrical engineers, &c. The first directors are: A. Bailey, "Hurley House," Saxon Road, Southall, engineer; J. C. Weber, 60, Drayton Avenue, West Ealing, W.13, engineer (joint managing directors with £300 each per annum as remuneration); R. Carter, no address given; and one other to be appointed at the first board meeting. Qualification, £250. Registered office: Pioneer Works, Hammond Road, Southall.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bodmin Electric Light & Supply Co., Ltd.—Particulars of £2,000 debentures, authorised January 19th, 1922. Present issue, £1,900, charged on the company's undertaking and property, present and future, including uncalled capital.

Insulating Products, Ltd.—Debenture, dated February 22nd, 1922, to secure £8,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.

Ellerd-Styles & Co., Ltd.—Debenture, dated February 21st, 1922, to secure £150, charged on the company's undertaking and property, including uncalled capital. Holder: H. R. Morris, Hill House, Montague Road, Felixstowe.

Deben Construction Co., Ltd.—Charge on certain land and premises in Woodbridge, Suffolk, dated February 16th, 1922, to secure all moneys due or to become due from company to Barclay's Bank.

British Engineers & Traders' Syndicate, Ltd.—Particulars of £5,000 debentures, authorised February 9th, 1922. Present issue, £1,500, charged on the company's property, present and future, including uncalled capital.

Harrison Brothers (Electrical Engineers), Ltd.—Debenture dated February 10th, 1922, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.

Telephone Manufacturing Co., Ltd.—Trust deed, dated February 17th, 1922, to secure £300,000 guaranteed 8 per cent. cumulative income bonds (with power to issue further bonds), charged on shares in the Installation companies, belonging to the company and held in its own name or those of its nominees and all further shares therein which may be acquired during the continuance of the secretary. Trustees: London City and Midland Executor & Trustees Co., Ltd.

Bishop's Castle Electric Light & Power Co., Ltd.—W. H. Thomson, of 19a, Coleman Street, E.C., was appointed as receiver and manager on February 23rd, 1922, under powers contained in debentures dated February 8th, 1915.

CITY NOTES.

Westminster Electric Supply Corporation, Ltd.

Sir E. Goulding, Bart., M.P., presiding at the annual meeting on March 1st, referred to the curtailment of output due to the coal strike, as shop lighting, &c., had to be restricted. The reduction in coal prices in October was followed by a substantial reduction in their charges for power and lighting. That policy had been abundantly justified, as the output had gone up very considerably. Their charge for power, a flat rate of 1½d. per unit was, he understood, at present the lowest in London. The company was the last to raise its price to consumers and the first to lower it. After referring to the reduction of wages with the fall in the cost of living, the increase in rates, and in National and Unemployment Insurance contributions (these contributions being now over £1,000 per annum) the speaker mentioned the success of the Central Electric Co.'s issue of 8 per cent. secured notes. The cost of the issue, including the discount, amounted to over £37,000, and it was agreed that the guaranteeing companies should take over that charge in equal shares. This year the Westminster Co. had decided to write off from its share (£18,000) the sum of £6,693.

The erection of the new plant at the Central Co.'s station enabled Davies Street station to be shut down, and as this building (which was held on a lease) would no longer be required for the purposes of the company, it had been sold, together with the plant, at a satisfactory figure. The whole of the expenditure on this station had been written off, and the shutting-down of the station would lead to greater economy in generation.

The new plant erected at Grove Road and Horseferry Road came into use in the last quarter of the year, and since then the cost of generation has been substantially reduced. After prolonged negotiations they had been able to come to terms with the City of Westminster as to the replacement of the arc lighting with modern incandescent lamps. These lamps, without using any more energy, had a greater illuminating power. The change-over was completed early in February, and was giving every satisfaction. The speaker referred briefly to the negotiations that were in progress with the Electricity Commissioners, and which they hoped might form the basis of a scheme to submit to shareholders for approval.

County of London Electric Supply Co., Ltd.

The net capital expenditure during 1921 was £195,749. The balance from net revenue account is £342,201, plus £18,595 brought forward. Debenture and loan interest, less tax, is £64,384; there is written off for expenses and interest on 1921 debenture issue £25,000; carried to reserve for taxation, £20,000; to reserve for depreciation, renewals, &c., £60,000; to general reserve, £100,000. After paying the 6 per cent. preference interest, less tax, and a final dividend at the rate of 11 per cent. per annum, less tax, on the ordinary shares, making 8 per cent. for the year, £21,787 is to be carried forward. Applications received during the year, 6,098 kW, making the total 94,000 kW; units sold, 51,220,079, an increase of 1,666,856. The consumers supplied, directly or indirectly, are now over 43,000. Results are regarded as very satisfactory, bearing in mind labour troubles and the coal strike. Mr. J. A. Hosker has been elected to the board in place of the late Mr. J. Atherton. Sir B. E. Greenwell has joined the board. The report quotes from the recommendation of the Commissioners in favour of the Barking site.

In order to provide for the normal capital requirements of the company, an issue of £500,000 seven per cent. redeemable debenture stock was made in October last. The issue was heavily over-subscribed. Resolutions are to be submitted at the annual meeting on March 14th for dividing each of the existing preference and ordinary shares of £10 each into ten shares of £1.

As to the associated companies, the South London Electric Corporation, Ltd., has declared a final dividend on the ordinary shares at the rate of 9 per cent. per annum, making 7 per cent. for the year; the Bournemouth & Poole Co. a final dividend on the ordinary shares at the rate of 7 per cent. per annum, making 6 per cent. for the year. The business of the Coatbridge & Airdrie Electric Supply Co., Ltd., continues to progress.

Para Electric Railways and Lighting Co., Ltd.

Gross receipts for year ended November 30th decreased from £296,898 to £267,310, and operating expenses from £175,032 to £163,891; difference in exchange rose from £9,741 to £58,796, on account of the heavy fall in exchange from an average remitting rate of 14.93d. in previous year to 8.39d. this year, leaving net revenue at £44,623, compared with £112,124. After providing for income tax, debenture charges, &c., and adding the amount brought forward, the balance was £5,391, against £81,057, transferred to depreciation and renewals reserve. A further factor which seriously affected net revenue was inability of the municipality to pay accounts for public lighting. Interest on sterling Treasury bills held by the company in respect of lighting accounts of previous years remains unpaid, consequently bills have been written down to present market value from reserve created against this contingency. The directors regret that dividends on the preference and ordinary shares cannot be paid this year. The preference shares are cumulative.

St. James' & Pall Mall Electric Light Co.

Mr. Walter Leaf presided at the annual meeting of shareholders on February 28th, and in the course of his speech expressed satisfaction at the results obtained during the year under review. The tide of prosperity for the company was on the flow, as not only were results in the latter half of the year an improvement, but those of the present year were even better. The output had decreased on account of the restrictions necessitated by the miners' strike in the earlier part of the year. Prospects were very bright; the re-building of Regent Street promised a large increase in business in the near future, and the "saturation point" was still far off. During the coal strike the stocks had proved just sufficient to save the company from the necessity of buying foreign coal at exorbitant prices. Owing to the uncertainty brought about by this dispute the company had not felt justified in reducing its prices to consumers, but when it was considered that the maximum price per unit had only been increased from 6d. to 7½d., it would be agreed that the charges were reasonable. The company expected to announce a number of concessions in its tariff very shortly. The capital account showed a large increase in the expenditure upon mains and plant. The first of these had been due to the growth of the business; the latter arose from the continued process of conversion of the Carnaby Street station from a generating to a transforming station. This was approaching completion, and it would not be long before the whole of the power was generated at Grove Road. 3,500 kW of converting plant had been installed during the year. A liberal provision had been made for depreciation and contingencies. Turning to the extensions of the Central Co.'s undertaking, which had been carried out during the year, Mr. Leaf said that the new repair shop had been completed and equipped. The main structure of the new boiler-house was almost finished, and the cost had been kept within the estimates. An additional large cooling tower was completed, ready for the present winter's load. The first of the two 10,000-kW turbo-generator sets was put into commission in the summer, and

this enabled both parent companies to close down their old steam plant. The second set had been completed, but the delay in erecting the two 50,000-lb. B. & W. boilers had retarded starting-up. The set was thus too late for the winter's load, but would be in commission shortly. Considerable economy had been effected by the new turbo-generator, the estimated saving in coal alone being about £6,000. An agreement had been made with the Chelsea Co. for a largely-increased supply direct from Grove Road. This supply would be available within the next six months. The cost of the extensions had necessitated the issue of £500,000 8 per cent. five-year notes in April last. This involved heavy interest charges, which led to a higher production cost per unit. It was hoped, however, that the increased efficiency of the modern plant would counterbalance this, and even reduce the total cost. A claim had been made on the Central Co. for Corporation Profits Tax. Now public utility companies with charges limited by statute were exempt from this tax until December 31st next. As the company could only supply other companies whose charges were limited, it was evident that the price per unit charged by the company could not exceed that charged to the public. But the claim was made upon the ground that the Central Company's Act did not expressly include a limitation. If the claim were valid the amount of the tax would have to be added to the prices charged to the receiving companies, so that, in spite of exemption granted them by the Act, they would actually be subject to the tax. This was manifestly wrong, and the claim was being resisted to the utmost. This matter led to a further serious question. The exemption period terminated with the present year, and then all public utility companies would be subject to the imposition. Therefore, in common with other companies, the company was taking steps to represent to the Government the injustice of this tax, which really was only an additional income tax upon those who held ordinary shares in joint-stock companies. The chairman briefly referred to the suggested re-organisation of the London electricity supply. He then paid a tribute to the loyalty of the staff, and spoke with appreciation of the services of Sir Alexander Kennedy.

Charing Cross, West End, and City Electricity Supply Co., Ltd.

The directors' report for 1921 gives the following results:—

West End Undertakings.—Gross earnings £312,532, against £311,045 for 1920; expenses, excluding depreciation, £212,116, against £208,214 for 1920. Net earnings £100,415, against £102,830 for 1920. Including £12,391 brought forward and £6,506 for interest accrued for 1921, the total available is £119,313, less £17,829 for debenture interest and £22,000 put to depreciation. The preference dividend absorbs £18,000, and 9 per cent. for the year on the ordinary requires £36,000. £12,500 is put to general reserve (income), and £12,983 is to be carried forward. Total connections: 847,060 (30 watt equivalent); lighting, 490,245; heating, 104,481; power, 252,334 (10,147 h.p.).

City Undertaking.—Gross earnings £439,772, against £418,746 in 1920; expenses £328,493 against £355,062 in 1920; net earnings £111,279, against £63,685 in 1920. Including £4,491 brought forward, there is £115,770 available. Debenture and other interest requires £47,889; preference dividend £18,000. £32,181 is transferred to general reserve (income), and £17,700 is to be carried forward. Total connections: 982,370 (30 watt equivalent); lighting 360,811; heating, 164,233; power, 457,326 (18,391 h.p.).

The report contains the same brief references to the Electricity Supply Bill and the Electricity Commissioners' inquiry in London as appear in other reports. Meeting held on March 9th.

Brompton & Kensington Electricity Supply Co., Ltd.

Credit balance for 1921, £41,041, plus £1,776 brought forward. After paying 7 per cent. cumulative preference dividend for the year, putting £5,308 to depreciation account, and £10,000 to reserve fund, 12 per cent. for the year is paid on the ordinary shares, £1,000 is paid to directors as additional remuneration, and £3,733 is to be carried forward. The gross receipts increased from £102,372 in 1920 to £119,130, and the expenses from £59,469 to £69,089, leaving the net receipts at £41,041, as against £42,903 for 1920. Customers connected increased from 7,896 to 8,264; 35-watt lamp equivalent connected increased by 29,876, as compared with 39,784 in 1920. Average price obtained per unit, 1920, 5.303d.; 1921, 5.236d. The report refers briefly to the negotiations now proceeding with the Electricity Commissioners for effecting agreement regarding a scheme for London. Meeting: March 16th.

City of London Electric Lighting Co., Ltd.

The capital expended during 1921 was £325,746. The revenue balance available for dividends, &c., is £132,243. Dividends on the first (6 per cent.) and second (8 per cent.) preference shares are paid, and 14 per cent. on the ordinary, leaving to be carried forward £29,844. The directors state with regard to the Electricity Commissioners' inquiry into schemes for the London and Home District that they were not concerned in the promotion of any scheme, but had to appear in opposition to one of them with a view to securing exclusion therefrom of the company's generating station and distribution area in Southwark. The scheme in question was rejected by the Commissioners. In December, 1921, the Commissioners issued a preliminary report indicating their intention to set up a Joint Electricity Authority for the district, but they did not express their intention to adopt any particular scheme in the absence of agreement between the promoters. The company's service during the prolonged strike was maintained with great difficulty and expense, and, in May, recourse was had to oil fuel. In view of the desirability of having alternative sources of fuel supply, the directors have determined to continue the use of oil fuel for a certain proportion of the company's requirements. After many disappointing delays on the part of the manufacturers the additional plant, referred to in the last report, has now been completed, and will be available for meeting the increasing demands on the company, as well as for giving a supply in bulk to another undertaking. Meeting: March 15th.

Underground Electric Railways Co. of London, Ltd.

The report for 1921 shows that the receipts were £770,000, an increase of £190,322; the expenditure was £166,001, an increase of £45,937. Interest, plus income tax on the 4½ per cent. bonds, interest on the 6 per cent. three-year secured notes and the 6 per cent. first cum. income debenture stock are paid, also 4 per cent. on the 6 per cent. income bonds. £26,241 is available for special reserve for equalisation of interest. The income from investments was £764,328, which is £197,384 better than for 1920. In order to meet its capital requirements and the needs of its subsidiary companies, the company has obtained temporary loans from its bankers amounting to £1,100,000. The gross revenue from the five companies was £13,085,557, and after deducting all revenue liabilities (working expenses, interest, reserves, &c.) there remains a common fund of £909,272 (against £354,492 in 1920) to be distributed between the companies parties to the common fund agreements. The Metropolitan District takes £109,113; the London Electric Railway Co., £320,552; the City & South London Railway, £54,556; the Central London, £164,483; and London General Omnibus Co., £260,568. The Metropolitan District and London Electric Railway Companies have received the whole of their new rolling stock, and the greater part of it has been put into service. The Metropolitan District Co. has commenced the construction of works on a site adjacent to Acton Town Station to provide for the overhaul and maintenance of the rolling stock of all the associated railway companies. The service of through trains running over the Central London Railway and thence from Wood Lane to Ealing over the Great Western Co.'s extension line has been worked throughout the year, but, largely owing to temporary conditions affecting the operation, the results have not been as satisfactory as was anticipated. At the Lots Road power station an additional 15,000-kW turbo-alternator and condensing plant and new coal-handling plant have been installed. Four additional boilers are under construction.

Liverpool Overhead Railway Co.

Presiding at the annual meeting on February 28th, Mr. H. C. Woodward referred with regret to the fact that they had to present so unsatisfactory a report, after eight years of comparative prosperity, and that they were able to declare any dividend on the ordinary stock. With a decrease of over seven million passengers during the year, they could not pay an ordinary dividend without encroaching on their usual and very necessary revenue. It was due to serious loss of trade and dock work of all kinds, including ship repairing, aggravated by labour disputes. From the general tone of commerce, however, let them all hope that things were on the turn for better times in the port, although the recovery might be slow. The cost of fuel and all materials, also the rates of wages, had fallen since the end of the year, and this would help to reduce their working expenses. The railway had been maintained in an efficient condition, and the train track had been improved. This work was still continuing. They were entirely dependent upon the trade of Liverpool. It was really sad to a Liverpool man who had lived in the city for 60 years to see the quays being swept almost as clean on week days as they were accustomed to see on a Sunday. They had an uphill fight before them.

Llandudno and Colwyn Bay Electric Railway, Ltd.

At the annual meeting of the company on March 1st the chairman said that the profit for the year was £6,194, an increase of £2,635. The passengers carried decreased by 24 per cent., and the car miles run by nearly 10 per cent. Reference was made to the charges for energy, and it was stated that unless the Llandudno Council showed a more reasonable attitude toward a public utility undertaking of this character the company would be compelled to consider making alternative arrangements for supply. With regard to the prospects for the current year, they hoped that during the summer season they would not have anything like the disturbances and interruptions that occurred last year. He hoped also that further economies would be effected in the costs of operation. The company decided to run a Sunday service from the end of its private right-of-way in Llandudno to Colwyn Bay, but the Llandudno U.D.C. refused to give a supply of power on Sundays.

W. T. Henley's Telegraph Works Co., Ltd.

Mr. George Sutton, M.I.E.E. (chairman and managing director) presided over the general meeting at the Great Eastern Hotel, E.C., on Friday last, and in moving the adoption of the report, expressed the gratification of the board at being able to present such good accounts. He said that the new issue of ordinary shares which they made in January of last year had been sufficient for the needs of the company. It was thought by some of the shareholders that they ought to have issued the whole of the £400,000 authorised, but they decided only to issue £250,000, and the accounts showed that the remainder had not been required. On the other hand, the shareholders must not imagine because they had a balance of cash in hand of about £450,000 that they were wrong in making the issue they did. That money was used to pay off their debt to the bank, and they preferred to get out of debt rather than wait for a possible slackening of trade to improve their cash resources. Although they had such a good report, there had been a falling off in the trade, and he would try and explain how that had come about. The creditors were down by £100,000 as compared with last year. On the other side, the debtors were down by £145,000, and the stocks were down by £179,000. Those items were a sure intimation of falling trade, and the pace had been accelerated from that time last year up to the present time. How then was it, they might ask, with that falling trade they had been able to present such a good account? In the first place, it was mainly due to the circumstance that last year they brought into 1921 a very large order. The result was that in the earlier months of 1921 the factories were kept busy on the orders which had been brought forward, together with the current orders which were coming in. As the year went on, so the factories became less and less busy, and they were not fully employed to-day. The next point to be observed was that the charges against revenue were in certain cases lower than they were a year ago, and that had tended to increase the profit. Then the depreciation account was £9,000 down, because they had finished with the heavy depreciation due to the war. So important did they regard the question of depreciation that he would like to point out that the £26,839 charged to profit and loss for depreciation last year did not represent the full amount that they had charged against revenue. In addition to that figure they had expended £32,000 on the maintenance of property, which had been charged to revenue, so that altogether they had a total of £58,000 charged for depreciation and maintenance on a property which at the beginning of the year was valued at £417,000. The balance sheet was better than it had ever been as regarded assets. They always wrote down their liabilities as far as it was proper and right, but they did not write up their assets. It had been the vogue for some time for companies to take new valuations of their property and to put the new valuations into the accounts. They had never done that, but it was an undoubted fact that the value of their property must be a very much larger figure than that at which it stood in the balance sheet. From the inception of the company £463,000 had been written off for depreciation, and the balance sheet value of the property to-day was £530,000. There was a large quantity of machinery and plant, which stood in the books at a very low figure indeed, or very often at no value at all—it having been written off. That was very useful to them when they wanted to scrap obsolete machinery without making any charge against revenue. He was afraid to say what the value of that property was; but if instead of £530,000 they were to double it he did not think they would be very far out. Proceeding to refer to the Henley's Tyre and Rubber Co., of which they held all the shares, that company, he said, had had a bad year in common with every other company in connection with that industry. They had maintained their position in the trade, but to do so they had had to sell at unremunerative prices. That was the first bad report he had had to make in connection with that company. The prices at which they must sell were governed by the prices of others in the trade, and it was a fact that their greatest competitor had made huge losses. He was glad to say that the tire business to-day had improved. Even last year they had never had a set-back for their solid tires for commercial vehicles—it had been in pneumatic and tires used for pleasure purposes where the slump had come. With regard to the pension funds, they had not asked the shareholders to contribute anything this year. The staff deserved well of them. The pitfalls which had beset trade during the last two or three years had been avoided, and they were especially grateful to those who had done their buying during those troublesome and difficult times. The staff worked with goodwill, as was shown by the profitable operations of the company and the early production of the accounts. Regarding the present position, he regretted he could not see any immediate improvement for the foreign trade. Last year he told them that the outlook was not hopeful, and those anticipations had been realised. There was a demand in foreign countries, but they were not able to meet the competition. The low prices which were quoted against them, due to lower wages and the position of the exchanges, shut them out of those markets. They were not losing their goodwill. As a matter of fact, they were taking some orders in foreign countries, but they were taking them at unremunerative prices and at a loss. That was one of the contributions which the company was making at a set-off against any sacrifice which they were getting their workpeople and their staff to make, such as lower wages, reduced war bonuses, &c. The company was making sacrifices to provide work in the factory which was not yielding a profit. That was one way, but it was not the most important. The most important contribution which they had been making had been the large sums which year after year they had set aside for the extension of the business—more for the purpose of increasing employment than for any other reason. Since 1914 they had not been able to set such large sums aside as formerly, because of the big sums they had had to pay in taxation. As to the home trade and that from the British Overseas Dominions, there was a decided improvement. It had not fructified very much yet, but taking the two months of the present year that had elapsed, the inquiries and demands for prices were very much greater than they were in the latter months of last year. He did not think the home trade was going to boom yet, but it was satisfactory to be able to note an improvement. In his mature judgment the future of the industry was very bright. So far as the immediate future was concerned, he had no anxiety about maintaining dividends, and should circumstances be such as to permit of it, the board as it existed to-day would not be averse to paying larger dividends. He was not promising larger dividends, but he did not want shareholders to think because they had been consistent in paying 15 per cent., that no matter what the profits might be they were never going to get any more. So long as they could set aside a considerable proportion of the profits for the extension and development of the business and for reserves, the shareholders would be entitled to ask for a little more in the way of dividend if it could be paid.

Mr. W. J. Potter seconded the motion.

Replying to a shareholder, the Chairman said the Tyre Co. made a loss last year. They had written down everything they possibly could, but the balance sheet did not show a debit balance—it was an absolutely clean account. The company was very sound. It was making a splendid article; it had improved its trade; it had a great reputation, and he was confident it had a great future before it. Being a new company, however, it had not yet established the position to be able to stand the strain in the sales department which it had had to meet during the past year. The report was adopted.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—British Thomson-Houston Co.—£1,500,000 7 per cent. mortgage debenture stock.

Dealings in the following securities have been specially allowed by the Exchange Committee under Rule 148a:—

South Metropolitan Electric Light and Power Co.—6,532 seven per cent. cumulative first preference shares of £1 each, fully paid, Nos. 293,469 to 300,000; 3,634 six per cent. cumulative second preference shares of £1 each, fully paid, Nos. 396,367 to 400,000.

Fairbairn Lawson Combe Barbour.—18,470 new ordinary shares of £1 each, 10s. paid, Nos. 900,001 to 918,470.

Yorkshire Electric Power Co.—111,672 six per cent. cumulative preference shares of £5 each, issued at £4, partly paid and fully paid, Nos. 54,329 to 166,000, after issue of allotment letters.

The undermentioned have been ordered to be officially quoted:—

Manx Electric Railway Co.—3,140 5½ per cent. cumulative preference shares of £5 each, fully paid (Nos. 1 to 300, 21,636 to 23,435, and 25,001 to 26,040).

Telegraph Construction and Maintenance Co., Ltd.—The report states that Major H. Denison-Pender, D.S.O., has been elected a director to fill the vacancy caused by the death of Sir James Pender, Bart. During 1921 there was a net profit of £120,880, plus £115,388 brought forward. A further dividend of 7½ per cent., free of income tax, is to be paid, making 10 per cent. for the year; £20,000 to reserve fund; £10,000 to pension fund; £116,628 carried forward. The general business of the company during the year was satisfactory. Annual meeting March 9th.

London and Suburban Traction Co., Ltd.—The revenue for 1921 was £112,598, plus £2,100 brought in making £114,697. The directors propose a balance dividend of 2½ per cent. in respect of year ended December 31st, 1917, on cumulative preference and 1 per cent. on account of the year ended December 31st, 1918, carrying forward £11,523. —*Financier.*

Electro-Bleach and By-Products, Ltd.—The profit for the year ended December, 1921, after deducting repairs, standing charges, depreciation, reserve for income tax, E.P.D. and Corporation Profits Tax, is £13,115 plus £5,921 brought forward. The preference dividend is 7 per cent. for the year, and after £4,957 is written off the patent account, £79 remains to be carried forward.

Clyde Valley Electrical Power Co.—The directors recommend a final ordinary dividend at the rate of 10 per cent. and after £4,957 is written off the patent account, £79 year.

London United Tramways, Ltd.—The traffic receipts for 1921 totalled £575,837. Adding advertising and sundry receipts, gross revenue is £584,030, an increase over 1920 of £31,288. Working expenses, £473,573; a decrease of £9,024. Balance on working, £10,456; an increase of £60,312. After charging debenture stock and loan interest, there is a surplus of £59,474 as reduction of deficiency of £70,882 brought forward. The L.C.C. gave notice to complete purchase on May 2nd, 1922, of company's lines in Hammersmith. Sir W. M. Acworth presided at the meeting held on March 1st. He said that there had been a great improvement in the results, there being a surplus of £59,474, which would go to the reduction of the deficiency of £70,000 for the previous year. It was hoped that as a result of the current year's working there would be a substantial balance on the right side.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—During 1921 167 new premises were connected. The units sold were 6,507,318. The net profit is £18,147, plus £1,867 brought forward. After paying the preference dividends, a final dividend of 12 per cent. per annum for the last half year on the ordinary shares is to be paid, making 10 per cent. for the year. £4,014 is to be carried forward. The report contains brief reference to the Electricity Supply Bill and the London inquiry held by the Electricity Commissioners. With regard to the latter, neither the London Electricity Joint Committee, 1920, Ltd., nor the directors of this company are satisfied with the Commissioners' suggestions, but "negotiations are proceeding in an endeavour to arrive at a satisfactory solution of the problem."

Metropolitan Electric Tramways, Ltd.—According to the *Financial Times* the revenue for 1921, apart from dividends receivable, was £1,044,311, compared with £957,555 for 1920. Adding dividend receivable upon holding in North Metropolitan Electric Power Supply Co. and the sum brought forward, and deducting all expenses, including debenture and loan interest and provision of £67,500 for reconstruction and renewals, there remains £48,380. There is to be placed to reserve £10,960. The directors recommend a dividend on the 5 per cent. cum. preference shares: (*a*) balance of 4½ per cent. in respect of 1919; (*b*) 2½ per cent. on account of 1920; carrying forward £2,420. The traffic receipts totalled £1,031,534, an increase of £90,783.

Chelsea Electricity Supply Co., Ltd.—The profit for 1921 was £43,437, plus £2,249 brought forward and £2,424 for interest. Debenture interest absorbs £4,260; 6 per cent. on the preference shares, £1,800; £17,000 to reserve for renewals, depreciation and contingencies; £9,804 to writing off balance of the cost of extinction of founders' shares; 6 per cent. for the year on the ordinary shares, £14,831; carried forward £415. Lamp equivalent (30 watt) connected 359,278, an addition of 5,763 during the year; units sold 4,828,604, 87,524 less than in 1920.

Argentine Tramways and Power Co., Ltd.—By order of the High Court meetings of the holders of preference and the holders of ordinary shares of the company will be held at Winchester House, Old Broad Street, E.C., on March 22nd, to consider and, if thought fit, approve a scheme of arrangement.

Clarke, Chapman & Co., Ltd.—Dividend of 1s. 6d. per share, less tax, on the ordinary shares for the half-year, making 2s. 6d. for the year; £20,000 to reserve; £27,917 to depreciation; £5,000 to workmen's compensation; £15,719 carried forward.

Hastings and District Electric Tramways Co., Ltd.—The directors recommend payment of 1½ per cent., balance of arrears of preference dividend for 1919, and a dividend of 6 per cent. on the preference for 1921. £5,000 to depreciation; carried forward £1,044.

Newcastle-on-Tyne Electric Supply Co.—The final dividend on the 7 per cent. cumulative preference shares is announced, also the full dividend on the 5 per cent. preference shares for the year 1921.

Jas. Pitkin & Co., Ltd.—By direction of the High Court, a meeting of unsecured creditors will be held on March 15th at 28, Hatton Garden, E.C., for the purpose of considering and, if thought fit, approving of a scheme of arrangement.

Western Telegraph Co., Ltd.—Second quarterly dividend of 5s. per share, free of tax, being at the rate of 10 per cent. per annum.

Globe Telegraph & Trust Co., Ltd.—Quarterly dividend of 3s. per share less tax, on the preference shares, and 5s. net per share on the ordinary.

Stothert & Pitt, Ltd.—An interim dividend of 1s. per share, free of income tax, is announced.

American Telephone and Telegraph Co.—Dividend of 2¼ per cent. for the quarter.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1½ per cent. on cumulative preference shares.

Mackay Companies.—According to the *Financial Times* the accounts for the year to February 1st, 1922, show income from investments $4,309,252. Dividends paid absorbed $4,180,340. Operating expense, including Federal income-tax, transfer agents', registrars', auditors' and trustees' compensation, salaries, stationery, $82,771, leaving to be carried forward $46,141.

Canadian General Electric Co.—Quarterly dividend of 2 per cent. on the common stock, and a half-yearly dividend of 3½ per cent. on the preference stock.

STOCKS AND SHARES.

Tuesday Evening.

The City persists in thinking the Bank Rate will again be reduced in the near future. The probable upward movement which this would cause is, of course, being discounted already. At this particular season of the year the Government is seldom in want of ready cash, thanks to the way in which receipts are swollen by taxation payments. The War Loan is about 97¼, some 2¾ points premium above its original issue price. This contributes to the strength of investment stocks in every department of the markets. But it stands to reason that the remarkable series of rises, shown in our lists in the two previous weeks, could not go on indefinitely. Nevertheless, there are not many reactions, and there are 20 fresh gains.

The Home Railway group exhibits a noticeable buoyancy, with the somewhat striking exception of the Underground Electric Railways of London stocks. Metropolitan Consolidated rose 2½ to 37½. Districts a point to 27, and a number of the debenture and preference issues of these two companies, together with those of the Central London, City & South London and East London, have hardened to a greater or less extent. But Underground Income Bonds shed six points, falling to 71½, the 1s. shares dropped to 6s., and the "ten-pounders," as they are called, to 40s. It is again rumoured that the company is about to make an issue of fresh capital. This, taken in conjunction with the disappointment recently aroused by the declaration of a 4 per cent. dividend on the Income Bonds, has led to the heaviness. However, as just mentioned, the prior-charge stocks are good, and once more it is easier to sell than it is to buy these issues.

Amongst the newer stocks, North Metropolitan 8 per cent. preference, after a rise to 2½ premium, came back to 1½ premium, apparently on stag selling. Dissatisfaction with the method of allotment is still expressed by some of the shareholders. The Yorkshire Electric Power offer of preference shares was a great success, except from the point of view of would be allottees, who found their requirements drastically cut. The price opened at 5s. premium, from which it advanced to 7s. 6d. premium; possibly another 5s. will be gained as time goes on. Scottish Power 8 per cent. preferences are being steadily placed, and the price has advanced a trifle to 20s. 3d. middle. Newcastle-on-Tyne second debenture at 92½ is better, while some of the other recent issues may be quoted as follows:—

County Debenture	107	Shropshire	102
Reading	103½	Llanelly	101½
Midland Counties	103	Fife	100

The tendency during the past few days has been for the holders to get out of some of the stocks which are redeemable within a comparatively few years' time. There is no doubt that certain prices were run up unduly, having regard to the dates of repayment.

Electricity supply shares are generally strong. Advances have occurred in Charing Cross, Chelseas, City ordinary, County of London preference, Metropolitan preference, and St. James's shares. The rise in County of London ordinary is 12s. 6d., and City Lights are 2s. 6d. higher. Edmundson's non-cumulative preference at 1¾ are again half-a-crown up. London & Suburban 4½ per cent. first debenture stock at 52½ is several points to the good, and Yorkshire Electric 4½ per cent. first debenture at 58½ has also improved. A rise of 9 points in Rangoon Electric Tramways 4½ per cent. first debenture lifted the price to 91. Para first debenture rose to 52. Newcastle-on-Tyne ordinary and preference have both advanced to 13s. 9d. on the company's announcement that it is going to pay off the slight arrears on the 5 per cent. preferences. The company's 7 per cent. preferences strengthened to 20s.

Amongst telegraphs, Anglo-American preference at 97 is a point down, but the deferred stock further rose to 22. Eastern ordinary at 185½ is 2 higher. Globe preference advanced to

10⅞ and Eastern Extensions to 18¼. The list shows a robust tendency throughout. Henley's are 3s. 9d. higher at 1¼. Callender's hold their rise at 35s., and Siemens's continue strong at 25s. British Insulated at 1 13/16 are half-a-crown up. The Telegraph Construction Co. declares a final dividend of 7½ per cent., tax free.

General Electrics gave way a little to 21s. 3d., Edisons at 4s. 6d. and English Electrics at 9s. 6d. are both 6d. lower. Metropolitan-Vickers preference hardened up again to 1 15/16. The other movements in this market are mostly upward. British Electric Transformers are wanted at 22s. 3d. British Columbia Electric Railways show some little irregularity, the deferred and preferred being 2 points down at 60½, while the 4½ per cent. debenture stock at 66½ is 1½ higher. Brazil Tractions, after their four-point rise, reacted 1. Anglo-Argentine first preference at 3½ are ¼ off, owing to a good deal of natural profit-taking which met the extremely rapid rise of a week ago. The second preference are on offer at 3 7/16, and the 5 per cent. debenture stock at 75½ is 1½ lower.

The threatened labour difficulties have had no particular effect upon industrial shares in the Stock Exchange, and iron and steel, with those in the armament division, are slightly better on the week. Vickers firmed up to 9s. The rubber market has also taken on a less melancholy tone. Rubber itself shows a trifling improvement, and there is more hopefulness in connection with the produce than the market has been accustomed to for some time past. Rubber companies there are which can produce, of course, at 6d. to 7d. per lb., but the majority spend 1s. or more in getting their rubber, so that, even with the produce standing at 8½d. per lb., there is a profit only for a comparatively limited circle of rubber producers. Still, a mild demand is reported from America, and the rubber market is accustomed to take long views.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Mar. 7, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7	—	£8 11 6
Charing Cross Ordinary	7	8	5⅞	+ ⅛	7 18 3
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	4	6	4½	+ ⅛	7 1 2
City of London	13	14	11⅜	+ ⅛	8 12 4
do. do. 6 per cent. Pref.	6	6	1	—	6 0 0
County of London	8	8	10⅜	+ ⅛	7 8 10
do. do. 5 per cent. Pref.	6	6	9	—	6 13 4
Kensington Ordinary	7	9	6⅞	—	8 10 2
London Electric	2½	2½	1½	— 1/16	9 11 8
do. do. 6 per cent. Pref.	6	6	4	+ ⅛	7 10 0
Metropolitan	6	7	4⅜	—	7 7 4
do. 4½ per cent. Pref.	4½	4½	3⅝	+ 1/16	6 8 7
St. James' and Pall Mall	12	12	7⅜	+ ⅛	8 2 8
South London	6	7	2½	—	10 9 0
South Metropolitan Pref.	7	7	1¼	—	6 4 5
Westminster Ordinary	10	10	6½	—	7 8 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97	—1½	6 3 9
do. Def.	1½	1½	23	+1½	7 18 6
Chile Telephone	6	6	5 1/16	—	5 10 4
Cuba Sub. Ord.	7	7	7⅛	—	9 6 8
Eastern Extension	10	10	134	+ ½	6 8 1
Eastern Tel. Ord.	10	10	183½	+2	5 7 10
Globe Tel. and T. Ord.	10	10	152	—	6 6 8
do. do. Pref.	6	6	105	+ ½	5 11 7
Great Northern Tel.	22	24	264	—	9 0 8
Indo-European	10	10	84	—	7 7 1
Marconi	25	15	14⅛	—	7 14 8
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	6⅜	+ 1/16	*5 19 0
West India and Panama	Nil	Nil	6/-	—	Nil
Western Telegraph	10	10	18⅜	—	*5 8 10
Home Rails.					
Central London Ord. Assented	4	4	61	+1	6 11 4
Metropolitan	1½	1½	37½	+2½	6 0 0
do. District	Nil	Nil	27	+1	3 17 0
Underground Electric Ordinary	Nil	Nil	2	— ½	Nil
do. do. "A"	Nil	Nil	6/-	—6d.	Nil
do. do. Income	4	2	71½	—6	*5 12 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	81	— ½	8 9 0
do. do. 2nd Pref.	Nil	5½	58	— ½	8 3 0
do. do. 5 per cent. Deb.	5	5	75	— 1½	6 13 4
Brazil Tractions	Nil	Nil	39	—1	Nil
British Columbia Elec. Ry. Pfce.	5	5	68½	—	7 17 6
do. do. Preferred	5	9[8]/-	60⅝	—2	*7 13 0
do. do. Deferred	8	12[4]/-	60½	—2	*10 5 6
do. do. Deb.	4½	4½	6 1/16	+1⅛	6 17 9
Mexico Trams. 5 per cent. Bonds	Nil	Nil	18½	—1	—
do. do. 6 per cent. Bonds	Nil	Nil	28½	—	Nil
Mexican Light Common	Nil	Nil	17⅝	—	Nil
do. Pref.	Nil	Nil	36½	+1	Nil
do. 1st Bonds	Nil	5	65½	—	7 12 8
Manufacturing Companies.					
Babcock & Wilcox	15	15	2[1]/-	— 1/16	5 19 0
British Aluminium Ord.	10	10	15/-	—	—
British Insulated Ord.	15	15	1 13/16	+ ⅛	8 5 6
Callenders	15	15	12	—	8 11 6
,, 6½ Pref.	6½	6½	1 1/16	—	6 7 4
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	4/6	—6d.	—
do. do. 5 per cent. Deb.	5	5	62	—	8 1 4
Electric Construction	10	10	18/9	—6d.	10 13 4
English Electric	8	8	9/6	—6d.	16 17 6
do. Pref.	6	6	13/9	—	8 14 6
Gen. Elec. Pref.	6½	6½	20/9	—	6 5 4
do. Ord.	10	10	21/3	—6d.	9 8 2
Henley	15	15	37/6	+ 1/16	8 0 0
do. 4½ Pref.	4½	4½	9⅝	—	6 0 0
India-Rubber	10	—	⅜	+ 1/16	—
Met.-Vickers Pref.	8	8	1 15/16	+ 1/16	8 5 0
Siemens Ord.	10	10	25/-	—	*8 0 0
Telegraph Con.	20	20	25	—	*4 16 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances

Wednesday, March 8th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	8d.	..
a Ammoniac Sal per ton	£65	..
a Ammonia, Muriate (large crystal) ,,	£58	..
a Bisulphide of Carbon ,,	..	..
a Borax ,,	£31	..
a Copper Sulphate ,,	£29	..
a Potash, Chlorate per lb.	5d. to 5½d.	..
a ,, Perchlorate ,,	7½d.	..
a Shellac per cwt	£17 10s.	20/- inc.
a Sulphur, Sublimed Flowers ,,	£12 10s.	20/- dec.
a ,, Lump ,,	£11 10s.	20/- dec.
a Soda, Chlorate per lb.	3½d.	..
a ,, Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	5½d.	1½d. dec.
METALS, &c.		
b Aluminium, Ingots per ton	£120	..
b ,, Wire per lb.	1/9 to 4/6	..
b ,, Sheet ,,	1/6 to 2/-	..
p Babbitt's Metal and Anti-friction Metal—		..
Grade I per ton net	£147	..
Grade II ,, ,,	£106	..
Grade III ,, ,,	£64	..
c Brass (rolled metal 2" to 12" basis) per lb.	9½ d.	..
c ,, Tubes (solid drawn) ,,	11½d. to 1/-	..
c ,, Wire, basis ,,	10½d.	..
c Copper Tubes (solid drawn) ,,	1/1½	..
c ,, Bars (best selected) per ton	£90	..
c ,, Sheet ,,	£90	..
c ,, Rod ,,	£90	..
d ,, (Electrolytic) Bars ,,	£65 to £67	..
d ,, ,, Sheets ,,	£145 10s.	..
d ,, ,, Wire Rods ,,	£75 to £77	..
d ,, ,, H.C. Wire per lb.	10d. to 10⅛d.	..
f Ebonite Rod ,,	6/6	..
f ,, Sheet ,,	8/-	..
g German Silver Wire ,,	2/6	3d. dec.
h Gutta-percha, fine ,,	12/6	..
h India-rubber, Para fine ,,	11d.	½d. dec.
i Iron Pig (Cleveland Warrants) per ton	Nom.	..
i ,, Wire, galv. No. 8, P.O. qual. ,,	£27	..
g Lead, English Pig ,,	£22 5s.	2½/- inc.
g Mercury ,,	£11	..
e Mica (in original cases) small per lb.	3d. to 3/-	..
e ,, ,, ,, medium ,,	4/- to 8/-	..
e ,, ,, ,, large ,,	10/- to 20/- & up	..
p Phosphor Bronze, plain castings ,,	1/1	..
p ,, ,, drawn bars and rods ,,	1/8½	..
p ,, ,, rolled strip & sheet ,,	1/8½	..
p ,, ,, Wire ,,	1/3	..
e Platinum per oz.	£24	..
d Selenium Bronze Wire per lb.	1/2	½d. dec.
r Steel, Magnet, in bars ,,	1/-	..
n Tin, Block (English) per ton	£143	60/- to 70/- inc.
q ,, Wire, Nos. 1 to 18 per lb.	8/-	3d. dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dunnis & Co.

An Employment Register for Boys of 16.—A committee composed of headmasters of public secondary schools has offices at Howard Hotel, Norfolk Street, Strand, W.C.2 (telephone: Central 5429), and interests itself in the problems confronting the boy of 16 and upwards who has left school and is taking his first step in professional or commercial life.

The committee has been able to place 251 boys in employment during the last six months. There remain, however, many boys of marked technical ability for whom openings in their chosen professions are few and far between. We believe that employers will find it of real benefit for boys to be introduced to them from public secondary schools, who have received a sound general education of approved standard up to the age of 16 or 18 years, and who are personally recommended by their headmasters.

Bribery Prevention.—The Bribery and Secret Commissions Prevention League, inc., which for many years has done very useful work in the direction indicated by its title, is suffering, like many other organisations, from the prevalent depressing conditions, and in view of the fact that "there was never greater need of the League than at present," it is appealing for new members to take the place of some who are resigning because they cannot maintain their subscriptions. We commend the appeal to the notice of our readers. The offices of the League are at 9, Queen Street Place, London, E.C.4. A line to the secretary will bring along a copy of the current *News-Sheet*.

The New Spanish Tariff.—After a series of tentative measures, Spain has at last established the new Customs tariff, anxiously awaited in industrial and commercial circles, which were impatient to see an end to the provisional period dating from the application of the draft tariff published last May. The new *régime*, unless Parliament decides otherwise, will remain in force until 1927, and a short sketch of its provisions should be of interest, in view of the radical changes from the tariff hitherto in force.

THE BRITISH INDUSTRIES FAIR.

(*Concluded from page* 298.)

Birmingham Section.

Messrs. May & Padmore, Ltd., showed heating and cooking apparatus, including a 250-W silica-tube immersion heater, protected by a stout wire guard. A range of "Maymore" fires was displayed. By means of a special form of enamel, these are produced in a variety of beautiful colours, and are very artistic.

The Consolidated Pneumatic Tool Co., Ltd., had a display containing a number of its electrical appliances. Among these were the "C. P." universal welder, described in our issue of February 17th. Numerous drills of various sizes and types were displayed. One of these was a sensitive drill stand for drills from 5/16th in. to ¼ in. with a lever working against a spring, which returns the lever to its top position when released. The Wayne cable reel, also previously described in the Electrical Review, was one of the firm's exhibits. Blowers, chipping hammers, and grinders with motors ranging from ⅛ to 1½ h.p., were included. In a case armatures of many sizes, in various stages of construction, were shown.

The "Pneulec" Machine Co., Ltd., had an exhibit consisting of machines used in the foundry, including a jar ram moulding machine, electrically operated. In using this machine the pattern is bolted to a table, the moulding box is put into position and filled with sand. A lever is then put over, and this actuates a ramming motion. When the sand is rammed into place the lever is returned, a lifting lever is put into engagement, and the mould is lifted clear of the pattern. The lifting height is adjustable to a maximum of 9½ in. Other machines shown were a smaller machine similar to that described above, but worked by hand-power, and a "roll-over" core-making machine. Core-oils for binding the sand when moulding were also exhibited, as well as a number of samples of cores made of treated sand.

Messrs. Holt & Willetts showed several types of hoists, winches, pulley blocks, &c. Amongst these was a 3-ton hauling winch, fitted with warping drums, and driven by a totally enclosed motor. Another machine shown was a direct-coupled lift engine fitted with an electro-mechanical brake and push-button control. A 3-ton overhead travelling "crab" was

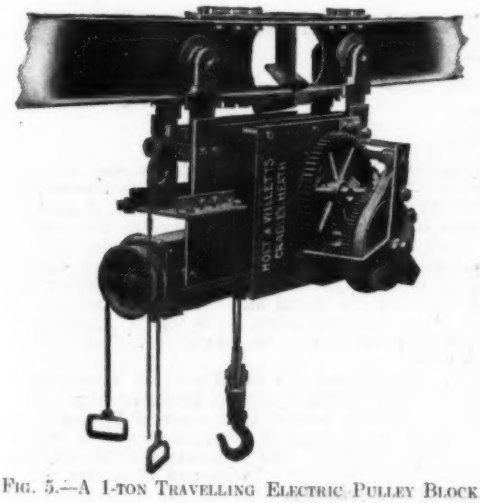


Fig. 5.—A 1-ton Travelling Electric Pulley Block.

exhibited, suitable for a double-girder overhead electric crane. This appliance has a lifting speed of 25 ft. per minute, and can travel along the crane bridge at 78 ft. per minute. An electric lifting and travelling pulley block (fig. 5), capable of lifting 1 ton at a speed of 20 ft. per minute, for running along the bottom flanges of a rolled steel joist, also appeared on the stand. Other exhibits were a 3-cwt. capacity belt-driven friction hoist and a direct-coupled electric friction hoist with a totally-enclosed motor.

Messrs Thomas & Bishop, Ltd., demonstrated by means of motor-driven belt pulleys the efficiency of their "Cling-Surface" belt dressing.

The Firth-Brearley Stainless Steel Syndicate, Ltd., displayed numerous examples of articles manufactured of its special steel, including valves, pump spindles, wire, &c.

The Ajax-Wyatt Furnace Co. exhibited a 6-cwt. furnace for the melting of non-ferrous metals. This was of the induction type, and made in England from American designs. It is fitted with a 60-kVA single-phase transformer, and is stated to be capable of one complete "heat" per hour, taking 275 kWh per ton when day-shifts only are being worked, or 230 kWh when being run continuously.

Bramlins Industrial Films, Ltd., exhibited and demonstrated the "Cinemak" portable kinematograph projector for the display of industrial films. This machine is illustrated in fig. 6. Perhaps its most important feature is the aluminium case which is closed while the machine is running, eliminating the possibility of personal contact with the motor and guarding against the spread of a fire if this should occur. The body of the machine consists of two aluminium castings, which enclose all the mechanism, and form the spool boxes. When ready for projection the machine is practically entirely enclosed, the only visible parts being the lense and a stopping device. The intermittent movement is of the "Maltese cross" type running in an oil bath. The motor speed is adjustable to a fine degree. A 400-W gasfilled lamp is fitted, and the machine can be run off a lamp socket upon either a.c. or d.c. The film spools are 10 in. in diameter, and will take a thousand feet of film. The machine has a separate re-winding mechanism for the film, which is passed over two independent rollers. By means of the stopping device mentioned the film's motion can be arrested at any point, and to enable this to be carried out safely a Crook's glass screen falls between the lamp and the film when the latter is stopped. The over-all size of the outfit is only 13¼ in. by 8½ in. by 5 in. We are

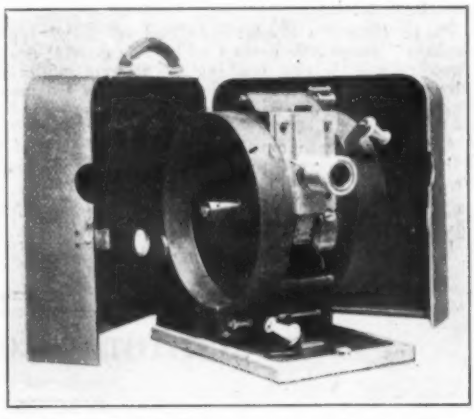


Fig. 6.—The "Cinemak" Portable Projector.

informed that the projector is made in London. It is ordinarily made for working on a 100-110-V supply, but a special resistance to enable it to be connected to a 200-250-V circuit can be supplied.

Clear Hooters, Ltd., showed examples of its electrical horn, the principle of which differs from that of the majority of these devices in that the sound is produced by magnetically vibrating a diaphragm instead of by striking the diaphragm. The parts comprising this horn are all very light. A small steel rod actuates a make-and-break action, which alternately energises and de-energises a magnet, and this attracts and releases a light metal centre attached to the diaphragm. The horn is produced in black or white metal finishes, and a specially-designed bracket is supplied, which permits adjustment of the horn in any position. The appliance weighs 2¾ lb., it is 12½ in. long, and consumes 18 W.

The International Electrolytic Plant Co., Ltd., exhibited a single cell in section and a set of five cells of its I.O.C.oxygen and hydrogen producing plant. Each cell is a self-contained two-electrode unit, and the electrodes are coupled up in series in forming batteries of cells. Each cell has its own feed and discharge devices. It consists of a thin frame of cast iron, to which the electrodes are bolted, separated by mica. The cell is divided into two compartments by an asbestos sheet. The gases leave by glass jars, and in the case of a battery discharge into common pipes. A third pipe conveys distilled water to the cells. To guard against corrosion by impurities in the water the anodes are coated with a thin deposit of nickel. A five-cell battery gives an output of 576 cu. ft. of oxygen (and twice as much hydrogen) in 24 hours with a current of 600 A. With 1,000 A the efficiency falls slightly and the output is about 900 cu. ft. in 24 hours. The usual results obtained give an oxygen purity of 99.6 per cent.

On the same stand the Metal Colouring Co. operated a new process for de-rusting and coating iron and for colouring non-ferrous metals. The usual iron-browning process is costly and absorbs much time. With this new system it is claimed that not only is the cost very small, but that it takes minutes where the browning process takes days. This is known as the "Brondse" process. It has four branches: the first, known as the "electro-black" process, is for oxidising steel

and iron a flat black. Rusty articles can be placed in the chemical bath employed and de-rusted by the action of an electric current. If the current is then reversed the article will be coated with a black oxide which will withstand very rough treatment. It is stated that the second branch, the "auto-black" process, adds nothing to the weight or size of the article, and that micrometers and other sensitive measuring instruments have been coloured by the process after completion. This is carried out by simple immersion in a suitable chemical bath. For the colouring of iron in various shades, from light yellow to dark brown, an electrolytic deposition process has been evolved. This is eminently suitable for art metal work. The fourth process is one for oxidising copper and its alloys. The surface produced is mechanically sound, and resists chemical action. The processes are based upon the use of various metal oxides which are not commonly employed.

Industrial Appliances, Ltd., displayed a 15/20-cwt. "Railodok" electric truck, which had been employed in conveying goods from the railway sidings to the stands in the Fair. One of the main features in its design is the heavy drum-type controller fitted with a patent locking device and cut-out. The latter is interlocked with the driver's saddle and the brake mechanism, ensuring that power is always cut off and the wheels locked when the driver vacates his position. The seat is reversible, so that the operator can always face the direction of travel. The motor is a series-wound, totally-enclosed, 1½-h.p. machine by Newtons, Derby, and the battery consists of 21 "Ironclad Exide" (I.M.V.4) cells with a capacity of 150 Ah. The loading space is 7 ft. by 3¼ ft.: the total weight of the vehicle is 1,860 lb., and it is capable of a speed (loaded) of from 6 to 8 m.p.h.

Mr. Frank Gilman's display consisted of many types of "Skatoskalo" pneumatic scaling tools. The general principle of these appliances is the working of pistons with rough edges by means of compressed air. The tools are made in various styles for a number of applications. There are special designs for Babcock & Wilcox boilers and for the Stirling type. A tool for use in curved pipes was shown, and it is stated that a well-known firm has used this for removing the scale from transformer cooling tubes prior to assembly.

Messrs. Accles & Shelvoke, Ltd., showed many of their small dynamos and motors, ranging from .10 to .33 h.p. One of the latest designs was a small dynamo for car lighting giving an output of 6 A at 6 V. A demonstration board fitted with five lights, a voltmeter, an ammeter, and four control switches, was used to demonstrate the practicability of the machine. In addition to this the firm showed a range of polishing motors and several dynamotors. On one side of the stand two pumps, one rotary and the other a plunger pump, driven by ½-h.p. motors, demonstrated the power of electricity and the small space taken up by electrical machinery.

The Rawlplug Co., Ltd., showed how its "Rawlplugs" could be applied to almost any material. Complete "Rawlplug" outfits were on view.

The Hockley Chemical Co., Ltd., had an exhibit of electroplating accessories, including several types of barrels and vats. Well-made resistance boards were a feature of the stand, and the company showed a number of double-scale ammeters for use with silver-plating outfits, showing, at the same time, the current strength and the amount of silver in pennyweights being deposited per minute.

Electrical domestic appliances were shown by The "Gem" Labour Saving Device Co., which had several examples of its light-weight "Gem" vacuum cleaner on view; and Messrs. Timpany & Tylor, who displayed motor-driven "Daisy" washing machines.

Insulating material was shown by Ebonestos Insulators, Ltd., which showed such articles as terminal blocks, switch handles, washers, bushes, &c.; and the Paragon Rubber Manufacturing Co., Ltd., which exhibited brushes, washers, and telephone parts in ebonite and other hard rubber compositions.

The Aqua Electric Co., Ltd., showed an improved type of the heater described in our issue of April 29th, 1921 (p. 544). This is a compact device, consisting of spiral heating elements passing through a perforated porcelain block. By means of valves either hot or cold water can be obtained from the tap. The heater has a loading of 6.6 kW. The appearance of the heater is very good; the case is of highly-polished aluminium.

Messrs. C. A. Vandervell & Co., Ltd., in addition to a large collection of small tools and gauges, showed one or two magnetos, and also dynamos for car and cycle lighting, and complete lighting outfits.

The General Electric Co., Ltd., informs us that all the electricity meters used on the stands were supplied by its associated company, Messrs. Chamberlain & Hookham, Ltd.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

JUBILEE CONFERENCE, 1922.

(*Continued from page* 321.)

Mr. S. Evershed, in recounting "some reminiscences of early days," began with an early experience of public electricity supply; recalled the laying of a submarine cable, and then spoke of that ever-memorable event, the coming of the telephone.

To begin with what, in the early days, was always called *the* electric light (it seemed appropriate to speak of it in the singular, because they seldom saw more than one arc lamp at a time) the town of Godalming, in Surrey, in a strange burst of municipal enterprise (possibly induced by a dispute with the gas company) determined to light the streets of the town by electricity. Accordingly a dynamo was installed in Pullman's leather mills, not far from the town, on the River Wey, where water power was available. The electric lighting of Godalming began on December 15th, 1881, and the leather mills were lit up by Swan incandescent lamps. Many more Swan lamps lighted the smaller streets of the town; but the High Street was illuminated by three arc lamps, "flooding the little sleepy town and the sky overhead with a blaze of glory."

"The street-lighting cables were laid in all innocence in the gutter, with nothing but their innocence to protect them from the wheels of carts or the hoofs of cart horses. I remember holding a pocket compass against one of those cables, just to see the needle deflect. Imagine my bewilderment when I discovered that, for some reason unknown to me, electricity for street lighting did not deflect a magnetic needle. That was my first experience of an alternating current."

Telegraphy began with a wireless telegraph (an optical system). Yet, the optical system was essentially an electric telegraph working on a wave length of about one forty-thousandth part of an inch, and using the human eye as the receiver. Then came the electric telegraph with wires to act as guides, and now they were using a wireless telegraph once more with a somewhat longer wave length!

It was in 1876, the year of the Centennial Exhibition, at Philadelphia, that he first heard of Graham Bell's telephone. Immense complexity: was the dominant factor in his mind. A year later he saw a drawing of one, and a new wonder came to light; there was an entire lack of complication. The thing was so incredibly simple that he at once set to work and made two Bell telephones, one to act as transmitter and the other as receiver; the two being identical, of course. His telephone consisted of a small bar magnet with some silk-covered wire wound in a coil round one pole, and a disk of thin sheet-iron which he cut out with a pair of scissors. He fixed those things inside a wooden box and cut a hole in the lid to let the sound into the transmitter and out of the receiver. He was already the proud proprietor of a telegraph line and to that he connected his telephones, one at each end.

Mr. E. Garcke took "a broad view of electricity," and pointed out that electrical science, probably more than any other, represented a beautiful sequence of facts and deductions—the result of years of observation and of the union of theory and practice. The phenomena of electricity were fundamental, not only to physics and chemistry, but also to biology and psychology.

The story of electrical legislation had been told many times and in different ways. For post-war statements of the position they could not do better than turn to the official reports of the Parliamentary and Departmental Committees, and the general conclusion to be drawn from the reports was that, notwithstanding the efficiency of British methods and means of attaining practical ends, there was an all-round lack of co-ordination. That was why he emphasised his remarks in the direction of an appeal for a larger outlook.

What of the future? The larger the view they were able to take of their own interests the better would be their understanding of the possibilities of amelioration. Society had its structures and functions which normally were complementary each to the other. But they frequently observed that structure was not equal to the function undertaken and that function, in turn, lagged behind structure. When those discrepant relations were accentuated, pathological conditions arose and found expression in strife and unrest. Evolution then called for readjustment; diagnosis suggested recuperation and restoration of normal relations on a new level, generally of higher consciousness. In the present condition of the world it appeared that international arrangements were necessary for the stabilisation of currencies, for the rehabilita-

tion of confidence and credit, for better distribution of raw materials, and for intensive production. But international arrangements were just the kind of functions for which the national structures were not yet developed. The League of Nations was a splendid ideal, but it did not yet appear to fit into the realism of present-day civilisation. That was a generality; in scientific and some other respects the signs of international understandings were hopeful. Did not the history of their industry afford analogies? They had translated the egoistic "me" into the associative "us," but they were constrained to stop short of the altruistic concept "all." They now had associations for practically every department of the industry to secure united action when collective interests were involved, and the Institution, no longer content with the view that its duties were confined to discussion of technical matters, acting on a broader policy of providing collective representation for all sections of the industry, was accelerating the advance of science and technics and commerce.

The supreme need of the nation in the present crisis, apart from the international arrangements referred to as difficult of attainment, was better or more sympathetic all-round co-ordination. What was not sufficiently urged was the value of better correlation between scientific research and philosophic generalisation. They collected more and more facts, but failed to combine them into coherent bodies of thought; thus they sacrificed in a large measure the increasing return from combined economy, bulk production, and rapid distribution. In order to realise the full advantage of their opportunity, it was necessary to take a wide view of the problem not only in its economic and social aspects, but also in all the other directions in which electricity was capable of benefiting the human race. Nothing was better calculated to foster that larger view than the present policy of the Institution to make contact between the electrical industry and its ever-widening environment.

Mr. W. Judd took "Submarine Telegraphy" as his subject and pointed out that from the mileage of a possible 10,000 in 1869 there were now 305,000 miles in operation, of which some 71,000 were Government owned. That figure included all submarine cables whether in shallow or deep water, the great bulk being manufactured in this country.

The cables of to-day were of the same general type as in 1866; there had been some developments, chiefly, however, in the direction recommended by Heaviside to put the maximum quantity of copper in long cables. The ratio of copper to gutta percha in the 1866 cable was 300C/400G, and the highest ratio known to Mr. Judd was 700C/360G.

In connection with the suggestion to include inductances in deep-sea cables, either by the Pupin or other methods, there must be borne in mind the great pressure, which was roughly one ton per sq. in. per 1,000 fathoms of depth. It had been suggested that if a consistent, constant, and waterproof insulator could be found having a dielectric resistance of a few hundred thousand ohms instead of many thousands of megohms per mile, a cable could be produced having small retardation and distortion, and whose attenuation would not be too great. It would be unwise to say that either of those methods was impossible, or that perfection had been arrived at in the design and construction of submarine cables.

The machinery for laying and repairing cables early took a practical form, and except for detail improvements remained much the same now, as had also operating instruments.

It would be seen then, that after the initial failure of 1858, the next attempts in 1865 and 1866 showed the type of cable, the methods of laying and repairing, and the apparatus for operating when laid, had already been developed by the truly great men who were the pioneers in that enterprise. Modern apparatus for operating cables had lost its pristine simplicity.

A new connection in those days necessarily involved a considerable change in a commercial routine—when, as in the East, the arrival of the cable almost synchronised with the opening of the Suez Canal that routine was so changed that those firms which did not change with the times sooner or later disappeared. The double acceleration of advices and transport also allowed of the advent of small firms with small capital, and the proud position of the merchant princes of the old times was attacked from all directions.

The appearance in those regions of a definitely electrical element stimulated the other branches of electrical development; thus, for example, he was able to assist in the introduction of the telephone in one colony and the establishment of electric lighting in another. The arrival of cables resulted in the establishment of land telegraphs in Japan (under British engineering auspices) and in China (under Danish engineering auspices) and there was no doubt that those western methods smoothed the way for the introduction of railways. The social effects of these new communications established by the early cables was marked; the feeling then existing of distance and isolation was lessened

(To be continued.)

HIGH-POWER MERCURY ARC RECTIFIERS.

By R. L. MORRISON, A.M.I.E.E.

Introduction.

Few modern developments have attracted so much attention and been so universally discussed as the high-power rectifier. By virtue of its outstanding characteristic, that of stationary operation, it provides at once a simple, inexpensive and highly-efficient mode of conversion, from alternating to direct current.

The use of the latter is being to some extent curtailed in many areas, it being considered that alternating current distribution presents certain advantages which outweigh any argument that may be put forward in favour of the other form of supply. This conclusion is to some extent justified in view of the heavy expense of running d.c. sub-stations, and any form of plant that will definitely mitigate such expenditure will fulfil one of the most pressing needs of our time and enable the use of direct current to be continued and even extended. Both forms of supply present advantages for particular conditions, and, taking everything into consideration, there is no doubt that the consensus of opinion would be in favour of direct current.

The large rectifier manufactured by Brown-Boveri is suggested as a solution of the problem. It is a stationary plant, and where semi-automatic control is used it is possible to give a very close approximation to the ordinary transformer, though by substituting completely automatic control its inherent advantages can be increased without unduly complicating the controlling gear, in fact, for such conditions the automatic arrangements are simpler than with the equivalent rotary converter.

The rectifier is finding an extensive field of application for the case of the higher d.c. pressures now being adopted for railway electrification, because of the ease with which these pressures can be handled without the necessity of having to overcome serious difficulties in design such as are met with in other types of converter.

Fundamental Considerations.

It is not proposed to deal more than very briefly with this aspect of the subject. For further details the reader is referred to an article by the author in this journal last year.*

The mercury arc, when operating in a vacuum, has the property of permitting the passage of a current in practically one direction only. This valve action is not the peculiar property of mercury, but is merely due to the arrangement of two electrodes, whereby one (the cathode) is brought to a state of electronic emission, and the other (the anode) is maintained at a temperature below that at which the formation of electrons is possible. In the commercial rectifier mercury is used because its vapour can be readily condensed and led back to the cathode without loss.

The efficiency of a rectifier is constant at all loads, the losses being the product of the current and the drop across the arc, the latter being constant for any particular size of rectifier. Consequently this class of converter shows to better advantage as the d.c. pressure is increased, because a higher kW output is handled without increasing the losses. Thus, taking the average arc drop as 20 volts, at 600 volts we have an efficiency of 96.8 per cent., and at 1,500 volts 98.6 per cent.

Single and Polyphase Rectifiers.

As the arc only deals with the positive half of the alternating waves the negative half waves must be given a positive sense

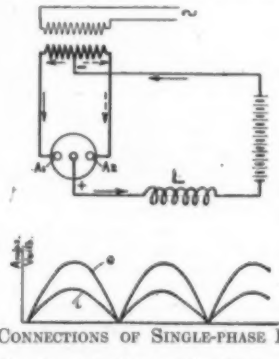


Fig. 1.—Connections of Single-phase Rectifier.

with regard to the d.c. circuit to make the proposition a commercial one. This is accomplished by connecting in the manner shown in fig. 1, which shows the simplest form of

*Electrical Review, February 17th, 1921, p. 217; and February 25th, 1921, p. 251.

single-phase rectifier having two anodes and a step-down transformer with a divided secondary, the mid-point of which is brought out and forms the negative pole of the direct-current system, the positive pole being the cathode. A consideration of this connection will show that the currents induced by each

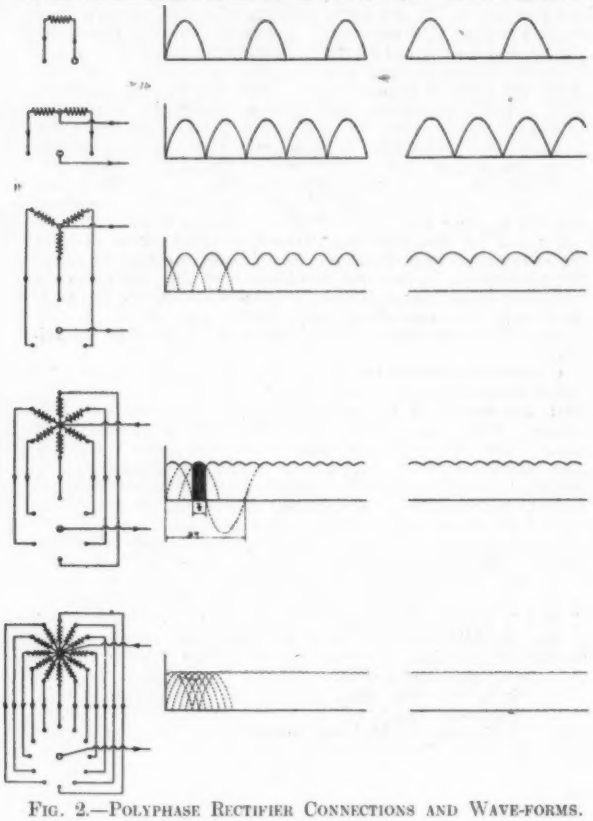


Fig. 2.—Polyphase Rectifier Connections and Wave-forms.

half-wave flow towards anodes A_1 and A_2 respectively, and that when one anode is in action the current cannot flow back through the rectifier due to the valve action.

Where the primary supply is three-phase, six or twelve-phase rectifiers are used. A marked improvement results in the d.c. wave form as the number of phases is increased, as shown by fig. 2, which also gives the simplified connections for each case. The six-phase arrangement is that in general use, because it gives what is for all practical purposes a straight line on the d.c. side, while it is simpler to construct, both as regards the transformer and the rectifier itself. The twelve-phase rectifier is only recommended in very exceptional cases where the circumstances justify the additional complication and expense. In the six-phase case a portion of the curve has been shaded to illustrate that the individual anodes only carry current so long as the momentary value of the corresponding phase pressure is higher than that of the adjacent phases or during one-sixth of a cycle. The arc passes rapidly from anode to anode at the points of intersection of the half-waves and takes the form of a cone with its apex centred in the cathode.

It is now well known that the rating for which rectifier transformers must be designed is higher than the d.c. output desired. The increase is due to the secondary winding being unfavourably utilised because of the large amount of copper required as compared with the normal case, on account of the r.m.s. value of the phase current being very high compared with the average value. We therefore find that for a six-phase rectifier the transformer must be 1.55 times bigger than the d.c. output, this figure being increased to 1.6 when the rectifier efficiency is allowed for. Still further increasing the number of phases gives for the twelve-phase case the figure 1.84 instead of 1.55, and for eighteen phases 2.12. On the other hand, for the three-phase transformer the figure is proportionately reduced. These indications show that the six-phase rectifier is most advantageous for general use because of the comparatively flat wave obtained without employing too large a transformer.

In fig. 3 is shown the core, removed from its tank, of a transformer for a 1,500-kW rectifier at 520 volts, the primary being designed for three-phase current at 6,500 volts 25 cycles. The four additional terminals per phase seen on the primary side are connected to tappings to give 2½ and 5 per cent. below and above the normal voltage, the adjustments being made by means of a three-pole oil-immersed step-switch.

The Construction of High-Power Mercury-Arc Rectifiers.

The problem of rectifying high powers is one fraught with many difficulties, due to the physical phenomena connected with it, about which little is known. In the early days many troubles were experienced, but all "troubles were made to be overcome," and one by one they were eliminated, until to-day we can with certainty say that the large rectifier is a formidable rival of, and in many respects superior to, the rotary converter. Briefly the difficulties that had to be overcome were:—

1. The manufacture of large cylinders that would be at once accessible and gastight.
2. The insulation used had not to deteriorate with high electrode temperatures, while the possibility of internal short-circuits, or "back-firing," as it is called, occurring had to be eliminated as far as it was possible to do so.

By far the most serious was that of "back firing." It will be gathered that to make the valve action possible the electrodes must be worked at certain temperatures relative to each other, and if for any reason one of the iron electrodes becomes hot enough to emit electrons the valve effect would cease and the current would flow in both directions between it and the opposing anode, this constituting a short-circuit. These occurrences may also be due to other causes, such as mercury condensing on the anodes in the form of drops, impurity of the material from which the anodes are made, insufficient vacuum, and unsuitable arc guidance. As a result of the experience gained over a number of years and the consequent improvements effected, it can now be said that internal short-circuiting is infrequent, and that such occurrences are now so confined that when they do develop it is, generally speaking, only during the first few weeks of operation, and can be considered a disease of infancy. Very little harm is caused to the rectifier and apparatus by a "back-fire," the principal effect in the normal case being the formation of globules on the affected anodes, or they may be pitted a little. Opening up for examination is not always necessary, the matter being frequently remedied by individually loading the anodes on to an auxiliary resistance, the current being gradually increased until the anode temperature reaches a very high figure, but not high enough to stop the valve action. In this way any irregularities on the anodes, such as globules, seem to disappear. When it was found necessary to open up, the anodes are re-polished and the rectifier re-assembled, after which it usually settles down to steady work and nothing further is heard of it. This question of "back-firing" in the early life of some of the rectifier cylinders is naturally receiving very careful attention, and as a result of the investigations at

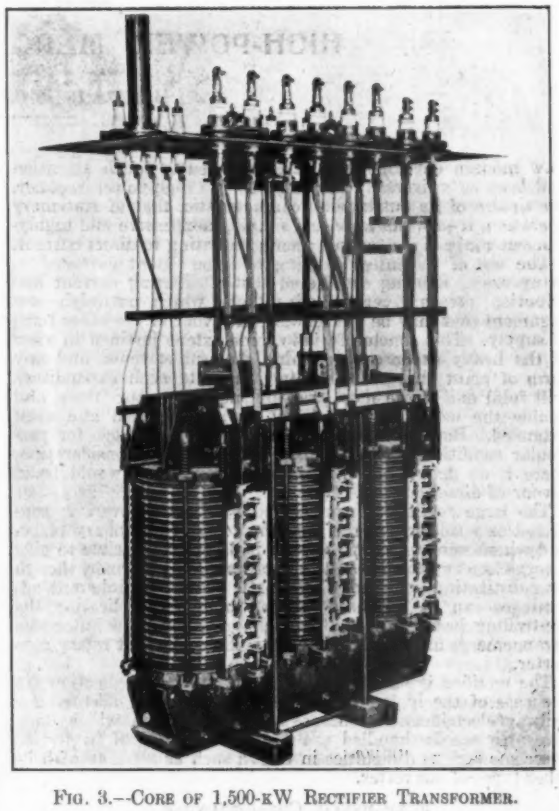


Fig. 3.—Core of 1,500-kW Rectifier Transformer.

present being made it is expected that such tendencies will be definitely eliminated.

Many attempts have been made during the last ten years to construct large steel rectifiers, but practically all have failed, the main reason being the difficulty of sealing against atmosphere; and where large rectifiers, consisting of many com-

ponent parts, are concerned, the question is not easy of solution, especially having regard to the extremely high vacuum at which of necessity this type of plant must work. Many different methods of sealing have been tried, but the best results have been obtained with the mercury seal (Brown-Boveri patent) which is a combination of mercury and asbestos for the hotter portions, and mercury and rubber for the cooler parts. The number of seals in a large rectifier are necessarily many, and are provided to facilitate the dismantling of the major portions should this be required at any time. The use of mercury as a sealing medium has the added advantage that should any filter inwards it can only find its way to the cathode, and will not interfere with the operation of the plant.

The development of the large rectifier has not been by any haphazard methods, but is the result of much patient endeavour on the part of those who for the past decade have

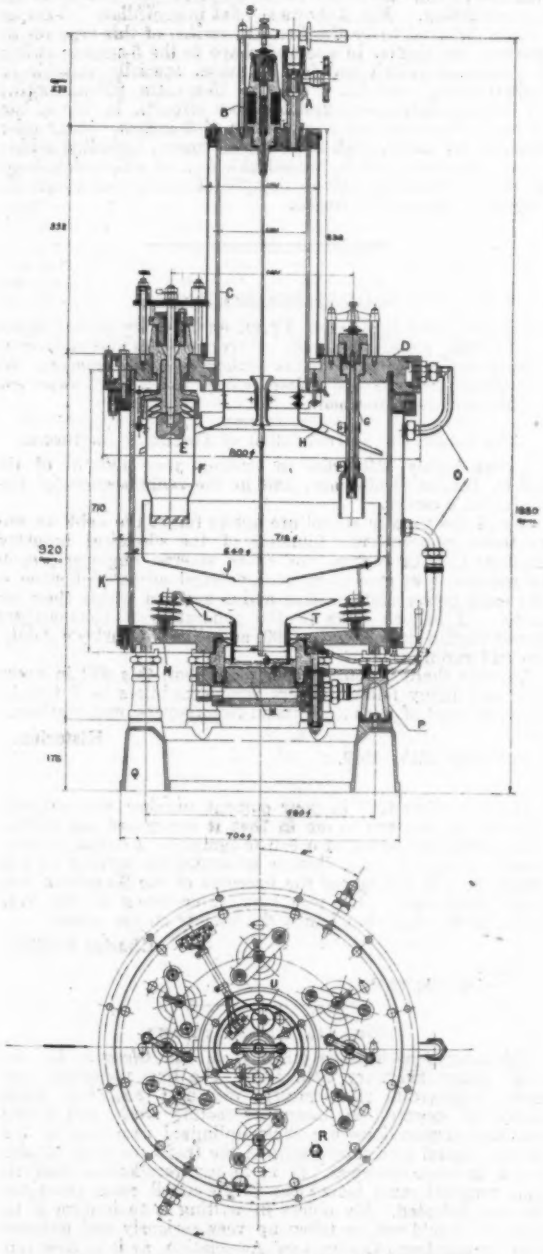


Fig. 4.—Section Through Large Rectifier.

been convinced of its possibilities and ultimate triumph. Their efforts have been undoubtedly crowned with considerable success, and while the rectifier as we know it to-day is in every respect a commercial proposition, its development will continue, and it might reasonably be expected that within a very short time it will be practically as reliable as the ordinary static transformer, and be installed in sub-stations that will be visited only at infrequent intervals. In a large measure this can be said even now to be an accomplished fact by the introduction of the completely automatically-operated rectifier, which has been tested out and proved to be in every way satisfactory.

A rectifier of the latest design by Brown-Boveri is shown in fig. 4. It consists of a large welded steel cylinder K (the arc chamber) and a narrower cylinder C (the condensing chamber) mounted above, the two being connected by the heavy anode plate D. The bottom of the arc chamber is closed in by the plate M, in the centre of which is the cathode, while the top of the condensing cylinder is closed by the plate carrying the ignition coil B. The whole rectifier is mounted on the porcelain insulators P, which insulate it from earth, these in their turn being carried on the foundation ring Q. As will be seen from the plan, there are six main anodes, E, and two auxiliary anodes, G, placed in a circle round the anode plate. The auxiliary anodes serve to maintain the arc when the load drops to a very low level on account of the main arc having a tendency to become unstable under such conditions. They might be said to constitute a single-phase rectifier within a six-phase one because they are connected externally with a small exciting transformer having a capacity of less than 1 kVA, and provide an auxiliary arc, which keeps up the temperature of the cathode spot. The mid-point of this transformer is brought out, as is done with the main transformer, and connected through a resistance and small reactance coil to the cathode.

(To be continued.)

CRABTREE QUICK-MAKE AND QUICK-BREAK SWITCHES.

Just as the bayonet lampholder is a peculiarly British product, so is the tumbler switch essentially the result of evolution in this country. Its origin was discussed in our pages in 1920, when it was shown that the original inventor was Mr. A. B. Blackburn, of the Edison & Swan Co., and that it was brought out some 34 years ago. Many firms have manufactured it, and innumerable forms have been patented, leading up to the excellent switches of the present day, which would seem to leave little scope for improvement; their reliability and durability, their neatness of finish, and the diversity of their applications reflect the greatest credit on their designers. The necessity for a quick-break action in these switches was amusingly illustrated by Mr. John H. Holmes in his discourse at the recent Commemoration Meetings of the Institution of Electrical Engineers, when he told how an architect, on the inauguration of electric lighting at a Wallsend café, discovered that electric light could be "turned down just like gas." Naturally Mr. Holmes lost no

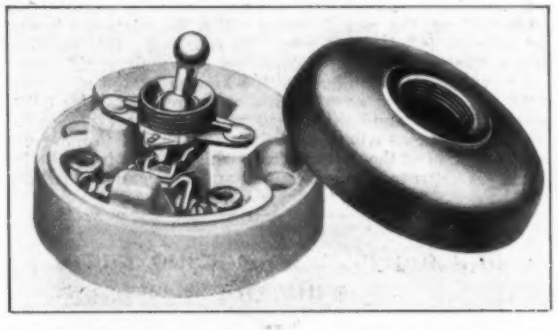


Fig. 1.—Crabtree 5-A Quick-make and Quick-break Tumbler Switch.

time in dispelling that illusion, and next day he devised the famous "loose-handle" switch which was the fore-runner of all quick-break switches and for many years remained a true master patent. A single slow break, by drawing out an arc, will do more damage to an ordinary switch than hundreds of operations in the correct manner. But the quick break which nowadays forms so essential a feature of all switches, large or small, is not in itself a complete solution to the problem of the perfect switch, which must be provided with a quick make as well. This requirement has been recognised and complied with in the case of some types of switchgear, but only a few makers of tumbler switches have fulfilled it successfully, and as a rule the additional feature has involved a material increase in cost.

Messrs. J. A. Crabtree & Co., Ltd., whose directors have had many years' experience in the manufacture of high-class accessories, set themselves the task of producing a quick-make and quick-break tumbler switch not as a "side-line," but as a standard article, manufactured on a quantity basis, at a price comparable with that of a high-class slow-make switch, and have placed on the market a variety of patterns embodying the quick-make as well as the quick-break feature, of which some particulars are given herewith.

The need for a quick make was not so pressing before the advent of the metal-filament and gasfilled lamps, for it is not

suggested that the present-day user manipulates his switches after the manner of Mr. Holmes's architect, or that an ordinary tumbler switch can be left at "half-cock" like the primitive switches in use in those early days. The trouble arises from the heavy rush of current at the moment of switching-on a circuit of gasfilled lamps, which is far greater than one would imagine, amounting to about six times the normal current. The starting current of electric radiators is also much greater than the normal running value. With carbon-filament lamps, on the other hand, owing to the negative temperature coefficient of carbon, the starting current was much less than the running current.

This initial rush of current with gasfilled lamps, passing at the very instant when the initial contact is made, may have very serious effects on the metal contact parts of a switch and lead to their rapid deterioration. Moreover, the increased use of domestic electrical apparatus is putting loads on the ordi-

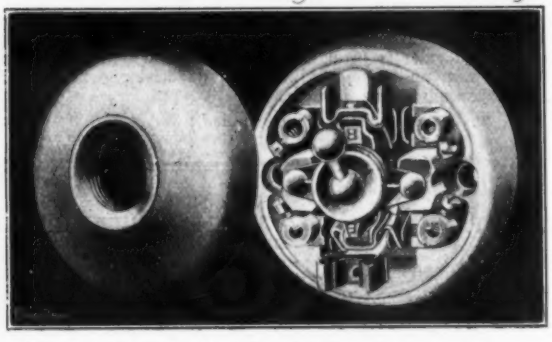


Fig. 2.—Crabtree 5-A "Flat Intermediate" Switch.

nary switch which it was not originally intended to control, with the result that rotary snap switches have often been substituted for the tumbler type.

In order to investigate the phenomena and to establish their designs on a scientifically sound basis, Messrs. Crabtree carried out an exhaustive series of tests with the aid of the oscillograph, a specially rapid kinematograph, and other devices. It was found that on a circuit of 250-volt gasfilled lamps taking normally 6.6 amperes the initial rush of current was 39 amperes; and on a circuit taking 10 amperes at the same voltage, the initial current was no less than 70 amperes. The current falls to normal in a fifth of a second; but the mischief is done at the moment of first contact, and any looseness in the mechanism of a switch not provided with a quick-make action prolongs the period during which the parts are in contact over an infinitesimal area. To cope with this problem, Messrs. Crabtree & Co. developed an extremely rapid switch action, which was examined with a kinematograph at a speed of 200 exposures per second, each exposure lasting for 0.0011 second; it was found that there was only one exposure between the moment when the switch commenced to move and the completion of the motion, from which it was inferred that the period between the first contact and the completion of the

Fig. 3.—Crabtree 15-A Switch for Heater Control, &c.

full contact was less than one-thousandth of a second, rendering arcing or overheating of the contacts due to concentration of current on a small area impossible. An equally rapid break is also obtained, independent of the rate at which the handle is moved, but actuated positively, so that the switch arm cannot stick in the contacts.

The Crabtree tumbler switches have also been thoroughly tested on heating circuits, and have been proved capable of controlling the larger currents met with in this connection. Switches which are rated for 10 to 15 amperes, at 250 volts, have stood a current of over 30 amperes, and 5-ampere switches up to 12 or 15 amperes. However, a wide margin of safety is desired, and a very conservative rating is therefore adhered to.

The switches are subjected to numerous inspections in the course of manufacture, and samples are mechanically tested for durability up to millions of movements. The springs are ground flat at the ends, and afterwards electro-tinned, and are mounted in compression.

The Crabtree switches are made in numerous patterns, some of which are here illustrated. Fig. 1 shows the 5-ampere flat switch, which has a base 2¼ in. in diameter and a projection of 1¼ in. All the moving parts are carried on a single pivot pin, which, like the contacts, is of phosphor-bronze; the contacts are so designed that the spring parts are remote from the arcing tips, and are sunk into the base, at a maximum distance from the cover. All the insulation is of mica, and the base of highly vitrified English porcelain. A similar switch known as the "Crabtree Junior" has a base only 1⅛ in. in diameter, and is rated at 3 amperes on 250 volts for house lighting. Fig. 2 shows a "flat intermediate" 5-ampere switch, believed to be the first flat switch of this type on the market, and similar in size and shape to the 5-ampere switch. A combined switch and fuse is made, specially suitable for train lighting, and fig. 3 shows a 15-ampere, 250-volt switch for heater control and gasfilled-lamp circuits, having a base 2¾ in. in diameter and a projection of 2 inches. Many other patterns are made, with a variety of covers, including ceiling, secret, flush-type, sunk, watertight, &c., of which details are given in a comprehensive catalogue of accessories which the company has recently issued.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Jubilee of the Institution of Electrical Engineers.

I was highly interested in reading your account of the I.E.E. Jubilee Conference, and in the reminiscences of Col. Crompton's career.

We of the modern school are apt to forget the debt we owe to these pioneers—the founders of the electrical industry. Perhaps Col. Crompton, and other veteran engineers, could be persuaded to give us a more detailed account of some of the early power stations and mains systems which they laid down. I believe some of the generators at Northampton power station date back to 1890, and, like "Charley's Aunt," are still running.

Possibly there is some earlier plant than this still in operation, and many fellow readers would doubtless be interested in an account of it as a diversion from super-power-stations.

Historian.

February 28th, 1922.

The "Leaderette" in your current number was naturally a source of pleasure to me in that it recognised my father's work in the pioneering of ocean telegraphy. I ought, perhaps, to add, however, that, though subsequently serving as President, he was not one of the founders of the Society of Telegraph Engineers. He was busy cable-laying in the West Indies at the time, but joined the Society on his return.

Charles Bright.

Leigh.
March 7th, 1922.

Hiring Out Electric Motors.

The cutting enclosed is taken from the *Glasgow Evening News*, dated February 27th, 1922. The first paragraph very seriously interests and concerns electrical concerns whose businesses depend on local contracting work, and if such powerful corporations use their unlimited resources of taxpayers' capital to compete against the trade we shall be compelled to cease business. It is in my recollection that the same proposal came before our City Council some years ago, but was defeated. My object in writing is to inquire if the proposal should not be taken up very seriously and energetically by our Local Contractors' Association, as it is now time to "get a move on." The Corporation is already hiring out cookers at the nominal rent of £2 per year, including installation.

Harry Smith.

Glasgow.
February 28th, 1922.

[The paragraph in question reads: "A special sub-committee is to inquire into the desirability of hiring out electric motors to power users at a rate of 10 per cent. on the cost. Owing to high prices many firms were unable to purchase motors, and if an opportunity to hire was given the consumption of power would go up in proportion."

The Corporation has the power to hire out motors, under the Act of 1919. Motors must be let on hire if the electrical

industry is to progress as it should, and if the electrical contractors succeed in preventing the Corporation from providing this service they must be prepared to provide it themselves.—Eds. Elec. Rev.]

The Selling of Light.

In your issue of February 24th you include an abstract, in your report on the "Selling of Light," from some of the remarks I made at this meeting. In the sentence stating "dealing with advertisements, Mr. Simon criticised the practice of lamp manufacturers advertising so extensively their own individual lamps. Valuable space was occupied in this way," &c.

I think your reporter has rather missed my point by not stating that I said that the space was, in my opinion, wasted in so far that every manufacturer cracks up his own article, whereas the public, to whom the advertisements are meant to appeal, must know by this time that there is practically a uniformity in quality of lamps amongst all the best-known lamp manufacturers, they being all manufactured under practically the same process and patents.

In my opinion there scarcely exists anybody who does not know that the electric lamp is the brightest and most practical form of illuminant. I said in my remarks that it was only natural that every manufacturer should want to emphasise the name of the type of lamp he was selling, and the manufacturer's name also. The rest of the space could be better occupied by trite remarks on the advantages of electric light as an illuminant, &c.

I know that in the joint advertisements of the E.L.M.A. this is done, but the individual manufacturers generally do not advertise in this manner. One very often sees in railway carriages, newspapers and other places of advertising, two or three well-known lamp manufacturers' advertisements practically emphasising the "same facts" about their lamps. What waste of money!

H. F. Simon, A.M.I.E.E.,
Managing Director, Electrical Installations, Ltd.

London,
February 28th, 1922.

[We fail to see where our report differs materially from Mr. Simon's letter.—Eds. Elec. Rev.]

Electrically-heated Oil Filters.

As far back as 1913 and 1914, I, personally, was connected with the manufacture of electrically-heated oil heaters for one of the largest firms of ship-builders in the kingdom. These were not an experiment, as we made a considerable number, and I believe, from reports I have heard since, that they have given wonderfully good service.

Admitted, the oil heaters to which I refer were not ostensibly for the filtering of oil, but to have reconstructed one of them not only to heat the oil but also to filter it would have been a comparatively easy matter.

Fred. J. Holtom.

Birmingham,
March 1st, 1922.

[Abbreviated.—Eds. Elec. Rev.]

The Fetish of the Quick-make and Quick-break Switch.

I was very interested in the remarks of Mr. C. W. Denny, and fully agree with his criticism on the folly of sacrificing substantial contacts of large area in the attempt to obtain a quick-make and quick-break switch movement.

As a general rule both the contact area and the area of cross-section are reduced well below the minimum required for a switch of a given rating, in order to ensure that the springs, which manufacturers assert never break, shall take the switch arm into and out of its contacts. Often the area of contact is less than half that of an ordinary slow-make and quick-break switch of the same rating.

The manufacturers assert that the aim of the quick-make and break switch is to prevent burning by reason of the switch arm being in only partial contact, but at its best the average quick-make and break switch, particularly the tumbler type, is only in partial contact as compared with an ordinary switch of any reputable make. The latter has about twice the contact area of the former in its normal position. It therefore follows that if for some reason the human element should fail, and as a consequence the switch arm be left half in and half out of its normal closed position, its area of contact would be not less than that of the average quick-make and quick-break switch at its best.

Switches of the tumbler type, when once installed, are seldom or never cleaned; the contacts become dirty or corroded, and thus offer a continually increasing resistance to the passage of the switch blade, whilst simultaneously the springs become weaker by continual usage.

Under these conditions, if one must rely on the springs only, the contacts must of necessity be of the flimsiest description.

A quick-make and quick-break switch mechanism is a thing to be desired in certain positions, but never at the sacrifice of contact area, and should always be accompanied by a complete positive action which, if the springs fail to function properly, will move the switch arm completely into and out of its contacts.

There is one, and I believe only one, such switch of the tumbler type on the market (made by the Wandsworth Co.), and in this the contacts are fully as heavy as those of an ordinary switch of equal rating. This is only possible because the makers can fully rely on both a spring action and a full positive action, the one following behind the other. Such a switch as this could be relied on to function properly in any position within its capacity, and it is certainly more desirable than one with a positive feature only.

If, however, I had to choose between a switch having only an independent quick-make and break with no positive action and a switch with a positive action, but without a quick-make feature, I would choose the latter every time.

A. C. Wynne,
Engineer.
The Wandsworth Electrical Mfg. Co., Ltd.

Birmingham.
February 28th, 1922.

As inventors and manufacturers of a range of quick-make ironclad switches we were much interested in a letter under the above heading in your issue of the 24th ult.

The writer of the letter dealt chiefly with the quick-make tumbler switch. We are not concerned with this, and think we may safely leave the manufacturers of these switches to deal justly with your correspondent, but in passing, we cannot refrain from asking Mr. Denny if he has never heard of the maids and children playing with a slow-make switch to see the "fireworks."

With regard to the larger type of protected knife switches referred to Mr. Denny hits the nail on the head when he says "in fact it is difficult for him to know when a switch is partially closed if the switch is protected by a cover." This statement is perfectly true, and is proof of the need of the quick-make switch. Many unskilled operators will automatically stop switching when a certain resistance is felt, and the switch may be left in partial contact, with the resultant consequences of heating, burnt contacts, and possible ultimate destruction of the switch.

A *good* quick-make switch is a positive cure for this, and absolutely prevents "inching." We italicise the adjective, as the performance must, of necessity, depend upon the class of switch installed.

The remarks regarding breaking of quick-make switches by the spring must obviously refer to the tumbler class of switch, as in larger types a positive "kick off" is admittedly necessary and can be obtained. In addition, in a well-designed quick-make switch a positive "follow on" make should be an inherent part of the design.

Mr. Denny's remarks on pressure contact are interesting, and at first would appear to be convincing. Experiments have proved, however, that equivalent pressure on contacts can be obtained in a properly-designed switch with good spring action.

The foregoing remarks apply to larger types of switches, where the design admits of sufficient room for efficient spring action.

In conclusion, our long and varied experience in the manufacture and design of switchgear has irresistibly driven us to the conclusion that a very considerable proportion of the troubles and failures of ironclad switches has been due to the careless operation made possible by the slow make.

Users and contractors are, we think, fully alive to this point, and quick-make switches would have been installed much more freely in the past but for their high cost.

Now that a first-class quick-make switch can be supplied at prices equal to the slow-make variety the doom of the latter, except for special apparatus, appears to be definitely sealed, and within a short space of time it will probably rank as a thing of the past.

W. L. Barber.
Managing Director
The Midland Electric Mfg. Co., Ltd.

Birmingham.
March 1st, 1922.

In your columns of February 24th last a correspondent, discussing the above subject, seems to have a distinct bias against the quick-make switch. He says practically nothing in support of his case—he does say that "with the old type of slow-make in large and small switches the operator, in closing the switch by hand, exerts a considerable leverage, and thereby closes the switch blades into strong and substantial contacts." Surely, in citing this property of the old type of switch, he is actually revealing its weakness (though he may call it an advantage).

The real advantage of the quick-make movement is most apparent with the larger sizes of switch. In large switches the ruling factor of design is the electrical current capacity.

In small or tumbler switches the mechanical strength of the parts limits the design.

In heavy-current switches experience has shown that the operator is either not strong enough, or is unwilling to exert the "considerable leverage" spoken of above, and the switch is not closed into its strong and substantial contacts; those switches are burnt out. In small switches the operator is frequently guilty of exerting too much of the "considerable leverage"; those switches break up.

It is surely obvious that if a switch (of any size) can be so designed (as a commercial proposition) that its speed and force of opening and closing are constant, and independent of the physical strength or temper, or laziness of the operator, that switch is superior.

There has recently appeared on the market a switch which exhibits perfectly the correct qualities of quick-make and quick-break, in that the movement of the operating handle, be it done slowly or quickly, gently or roughly, does not, either in closing or opening the switch, affect the fixed rate and force of the contact-making and breaking.

It is rather a pity that we do not differentiate between tumbler switches (electric cocks) and power switches (electric valves). In tumbler switches almost anything electrical will do, provided it will withstand domestic wriggling about and only costs a few pence. For power services switches must be electrically perfect and also of robust mechanical strength; they too must be reasonably competitive in price. Makers have found that they can offer quick-make and quick-break switches at the right prices. Why should they not make an advertising point of this exceptional feature of merit?

Black Friar.

Manchester.
March 2nd, 1922.

As an inventor of a quick-break switch, No. 11,086/02, I am interested in the correspondence in your columns *re* the *quick-make* and the quick-break switch. I have not been actively engaged in the electrical world for some years, and so have not seen the quick-make switch. I cannot help thinking, however (without seeing the switch), that a quick-make switch must almost defeat its own objects in quick-breaking. Perhaps your correspondents may favour me with a sketch or catalogue of the same.

D. R. Broadbent.

Royal Societies' Club, St. James' Street, S.W.1.
March 4th, 1922.

The Beckton Electricity Scheme.

I was interested in the article on "The Production of Light, Heat and Power," in the REVIEW, of February 10th, in which Mr. Seabrook hands out the "sob stuff" to the Junior Gas Association. What attracted me most was the alleged proposals of the Gas Light & Coke Co. to generate power at its Beckton works. He says that "the site is admirable (and I agree), and the arguments in favour irresistible." If so, why has not the Gas Co. put up a plant to generate power from coke fuel instead of waiting for the "recently approved station lower down the Thames?" Does Mr. Seabrook want the gas companies to control electricity stations? If so, let him consider how electricity is viewed at Beckton gasworks. In certain retort houses there they use electric power, because it has been proved better than hydraulic and compressed air. The motors, however, are very carefully hidden away or covered up lest they should be seen by visitors. The electrical repair shop is in a remote corner of the works, and on visiting days the door must be kept locked (by order). Why then, if electricity is efficient, do they desire to keep it out of sight? One is reminded, by these methods, of the ostrich with its head in the sand. Mr. Seabrook, further, cannot understand why the Beckton scheme was rejected. Let him spend a month or two in the Beckton works and he will see how effectively they try to put the "stopper" on anything electrical.

Gas-filled.

The "Leader" Cable.

Although temporary indisposition prevents me from consulting certain data, not here available, may I, in reply to Mr. Rollo Appleyard's very kind letter (ELEC. REV., March 3rd), be allowed a few words regarding the actual chronology of matters which may or may not have been steps on the way towards the present "Leader" cable system?

This system, by the way, might have been much more developed than has, actually, been the case, as a medium for electro-telegraphic signalling in either direction between ship and shore. This question I dealt with in some detail in a private correspondence it was my privilege to have with an Admiralty official.

Mr. Rollo Appleyard, whose distinguished war experience in the R.N.V.R. enables him to speak with authority, suggests in his letter that, at some future time, we may find that Germany was the first to use a submarine cable "Leader" fashion, and that Great Britain captured the notion from the enemy, and subsequently adopted it.

Is it not notorious that, for many years previous to the great war, German spies with plausible *bonhomie* penetrated to many places and got to know much?

I have mentioned in a former letter how, so long ago as in 1895, in connection with Admiralty inquiries, I, on instructions from the late Mr. M. H. Gray, made a private illustrated report, and suggested, *inter alia*, a certain use—outside submarine telegraph cables—of what I then called the "investigator" coil: a use merely developed from Mr. John Gott's search-coil recorded in the Journal S.T.E. now I.E.E.

Is it not possible—nay, probable—that news of the "investigator-coil" idea not only reached Germany, and was then and there put into practice in the parallel inductive system of the "Leader" cable and contiguous Gott search-coils connected to telephones, but that, years later on, this complete system was—as Mr. Rollo Appleyard suggests—captured and adopted by Great Britain?

Regarding the present writer's two-tone vibrating transmitter—appreciatively mentioned by Mr. Appleyard— and the Cardew transmitter from which the former was developed, as mentioned in the writer's articles in *The Electrician*, the present writer was the first to point out not only how two-tone conductive vibratory signals could be recorded on a Kelvin siphon recorder, but that this useful possibility likewise applied to Cardew's vibrating transmitter. Not even Mr. Edward Stallibrass, in his interesting *Times* letter, mentioned this fact, nor, to the writer's knowledge, is this fact referred to in any of the text-books, military or others.

Finally, it is more than probable that Mr. Axel Orling's ultra-sensitive yet extremely simple and easily workable "Jet" relay and amplifier, will extend the possibility of similar siphon recorder screed to two-tone and to Cardew signals inductively produced through a Gott search-coil.

E. Raymond-Barker.

London,
March 6th, 1922.

[In this connection it is interesting to quote Mr. G. W. Partridge's anecdote, in his discourse at the I.E.E. commemoration meeting, regarding the localisation of a fault in an underground cable in 1890. Mr. Partridge passed an intermittent current through the cable to earth at the fault, and had a 4-ft. coil made, which was carried along the Strand while he listened to a telephone receiver connected with the coil. This invention, he said, "to-day is known as the 'leader system' for guiding ships through minefields and fogs."—EDS. ELEC. REV.]

Station Troubles.

Enclosed is a snapshot of one of the "Troubles of Stations" in South Africa.

The evenings out here are fairly cool, the days are hot, during this time of the year—and a snake likes warmth.

The snake shown in the snapshot was found on a 3-wire machine at 8 p.m. one evening, having come into the station for warmth. It had wound itself around the collector rings; its tail was touching the commutator, and its head

resting on the warm bearing. I may add that it is one of the poisonous species, and we were on the tiptoe of expectation, expecting a nice short, as we were fully loaded and could not shut the machine down till 10 p.m.

Best of wishes to the REVIEW,

David W. Ritson,
Station Engineer.

Stellenbosch,
Union of South Africa,
February 1st, 1922.

The F.B.I. on Costs of Production.

With reference to your interesting editorial under the above heading, may I say that you appear to have missed the point in connection with the cutting of piece rates. When a time rate is paid it is on the assumption that a fair day's work will be done; and if on the payment being altered to piece rate the workman produces, say, four times as much as he did before, it shows that when paid by time he did not do a fair day's work, and that, therefore, the piece rate, which was based on the amount of work he did when paid by time, is too high. Your remark "Pay the worker for what he turns out, even if he earns twenty pounds a week" really means that if an employer, by bad luck or the artifice of the workman is led to believe that a certain article takes an hour to produce with reasonable industry and says he will pay 1s. 1d. each for these, he ought to be quite satisfied if the workman then produces the articles in ten minutes each.

My idea of an ideal piece-work system is somewhat as follows: It should be ascertained what is the maximum possible output of the work, *i.e.*, the output of a very skilled man working excessively hard. Forty per cent. of this maximum should be taken as the output for time rate pay, and piece rate be calculated accordingly; but the workman's maximum earnings should be limited to eighty per cent. of the possible output. I suggest this maximum to prevent the man injuring himself by over-exertion, as I do not believe in encouraging a man to work excessively hard, and a workman soon learns to judge his rate of working, so that the upper-limit would not often, if ever, cause injustice. I am aware that the scheme suggested is difficult and in some cases impossible to adopt, principally owing to the difficulty of ascertaining what is the maximum possible output, and there is room for difference of opinion as to the percentages. I do, however, feel confident that something on these lines should be aimed at. Costs of production cannot be at the correct level if we pay time rate for less than a fair output or an excessive rate per unit for a large output. Both mean the cost per unit being too high, but if the cost in the two cases be the same, the latter is obviously the lesser evil.

J. S.

London,
February 28th, 1922.

[We have more faith in the rate-fixing methods of large factories than to believe that an error, deliberate or not, of the order of six to one, in the time estimated to be occupied, could be made or agreed to. Output must be encouraged to spread overhead charges over a greater number of finished articles. Sales, and consequent profits, are, broadly speaking, not restricted. There is, therefore, no logical ground for limiting the earnings of the employé, whether on the staff or in the shops, except in accordance with his output.—Eds. Elec Rev.]

Christianity and Industry.

Your recommendation in the Review, of February 24th, of the Christian Order of Industry and Commerce savoured to my mind somewhat of patronage.

No doubt it is very comfortable to have a belief that all is, if not well, at least shaping well, without any bother. This does not, however, do away with the fact that many (shall I say, most) business men and firms of to-day are not even honest, never mind Christian. There is a very great need for some quickening spirit to do away with the general feeling that it is "clever" to be dishonest and a liar in business. What traveller would refuse an order simply because he has to say "we have it in stock"?

The electrical trade is not entitled to assume the Pharisee-like attitude of your leading article. How many thousands of yards of cable are installed in England to-day, which should have been "2,500-megohm grade"? How many hundreds of "galvanised" fittings are painted ones? What firms sell lamps strictly to their lamp agreement?

The Contractors' Association had an elaborate system of rebates for exclusive purchasers of certain goods, cable, accumulators and the like. What proportion of affiliated firms pay any attention to these regulations save only the all-important one of claiming for their rebate? No, sir! from the lowest office boy who is told to say on the telephone "our man is on his way, sir" to the highest director who profits by such methods and is the head of a ring or combine (are these things Christian?) there is a great need for a new outlook.

Some men do things in business they would blush to do in private life, and some men do things in both they ought to blush for.

When the day comes upon which a business man points out to the Income Tax authorities that they have assessed him too little, we may not need the "Christian Order," but until then kindly let us have as many aids to honesty as possible.

Midway.

March 3rd, 1922.

SALARIES OF TECHNICAL STAFFS.

Southampton Corporation's Action.

A serious difference has arisen between the Southampton Corporation and the E.P.E.A. and the E.T.U., as the organisations representing the members of the technical staff of the Corporation's electricity undertaking, owing to the following curiously-worded decisions of the Corporation, viz.:—

"With respect to all salaries and wages, not governed by awards, to recommend the Council in all cases where legally possible:—

1 (*a*) That a reduction of 20 per cent. be made on all sums not exceeding £499 per annum.
17½ per cent. on all salaries from £500 to £699.
15 per cent. on all salaries from £700 to £949.
12½ per cent. on all salaries from £950 to £1,249.
10 per cent. on all salaries over £1,250.

2 (*a*) All awards to be allowed to operate under the conditions which at present apply until October 1st next, when the subject will again be considered.

(*b*) With the exception of the technical and the electricity works clerical staffs electricity award where special reductions are proposed, but if these do not become effectual by April 1st next the above reduction of 20 per cent. shall apply in these instances.

(*c*) Notices shall in all cases where necessary be given."

The Council adopted the above recommendations of the Parliamentary and General Purposes Committee by a majority of eight on February 22nd, and the notices referred to have been served upon all the members of the technical staff of the undertaking and, in consequence, the executives of the organisations concerned take a serious view of the position created by such a challenge to the prestige of Joint Boards and Joint Industrial Councils.

The Southampton Corporation accepted and put into operation in July, 1920, the schedule of salaries and conditions of employment recommended by the National Joint Board for the Technical Staffs of Electricity Undertakings.

Apparently the reductions provided in the schedule in accordance with the variation in the cost of living are not sufficient to satisfy the Corporation in its desire for "economy." It is curious to note, however, that the decision of the Corporation is not applicable to any awards at present in operation, except in the case of the awards operating in respect to the electricity department. Further, the Council made its decision without consulting the employés concerned or the organisations representing them. In other undertakings such difficulties have arisen and an amicable settlement has been arrived at, either on the District Joint Board or the National Joint Board.

The Southampton Corporation, however, appears to be under the misapprehension that it can make arbitrary decisions. Although the E.P.E.A. addressed several communications to the Corporation, the latter has not seen fit to acknowledge them. The District Joint Board, at its meeting on February 27th, asked the Corporation to suspend the notices to the members of the technical staff pending the consideration of the matter by the National Joint Board. The Corporation, however, issued the notices, with the intimation that they would not operate if the employés concerned agreed to the reductions as proposed by the Corporation.

The dispute thus becomes a challenge. Obviously, the correct method for the Corporation to have adopted was to have referred its grievances to the National Joint Board. Such a course is still open, and it is to be hoped that the wisdom of such a step will be sufficiently apparent to enable it to agree. We understand, however, that the withdrawal of the notices issued to the employés is essential before the organisations representing them can agree to the matter being referred to the National Joint Board.

Bradford Textile Society.—An interesting paper on h.p. electric transmission was read recently by Mr. Harry S. Ellis, M.Cons.E., M.I.E.E., of Cardiff, before the Society. In the course of his paper Mr. Ellis said that pressures of 33,000 volts were becoming fairly common in this country, and he believed 60,000 volts would shortly be adopted in one or more isolated cases; 33,000 volts now appeared to be the standard pressure in this country for all long-distance transmission, whether overhead or underground, when large amounts of power were to be dealt with. The largest span in this country was to be found in South Wales, where an 11,000-volt, 3-phase, line erected for the South Wales Power Co. by Messrs. Callender's Cable & Construction Co. was carried by two tubular Kay poles spaced nearly 1,000 yards apart. In that case the dip or sag of the wires was more than 200 ft. A line spanning the Mississippi was slightly longer, namely, 3,182 ft. The longest transmission line in the world was 348 miles in length—belonging to the Southern Sierras Co., of California. The voltage was 90,000, which pressure was in the near future to be raised to 140,000 volts.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

4,509. "Telegraph and telephone systems." Ges. fur Drahtlose Telegraphie. February 15th. (Germany, February 17th, 1921.)
4,510. "Thermionic generators of electric oscillations." Ges. fur Drahtlose Telegraphie. February 15th. (Germany, February 16th, 1921.)
4,527. "Rheostat for controlling electric lights for vehicles, &c." Albion Motor Car Co., Ltd., and T. B. Murray. February 16th.
4,542. "Method of electrically welding high-speed steel to tool shanks, &c." E. Schoder. February 16th.
4,557. "Sand pipe adjusters for electric cars." J. Reid. February 16th.
4,574. "Electric lamp suspender." S. W. Hamlyn. February 16th.
4,587. "Charging secondary batteries." E. L. Burne. February 16th.
4,602. "Closed circuit magnetic switches." Siemens & Halske Akt. Ges. February 16th. (Germany, March 3rd, 1921.)
4,609. "Electric switches." P. Merguin. February 16th. (France, February 18th, 1921.)
4,615. "Electrical resistance thermometers." A. W. Mathys (Wilson Maculen Co.). February 16th.
4,618. "Electro magnets." Siemens Schuckertwerke. February 16th. (Germany, February 17th, 1921.)
4,620. "Electric conductors and wiring for electric circuits." E. W. Lancaster. February 16th.
4,621. "Electric appliances for cleaning, fanning, &c." E. W. Lancaster. February 16th.
4,631. "Ignition devices of internal-combustion engines." F. H. Royce. February 16th.
4,640. "Submerged electro-plating shaking, scouring, &c., barrels." F. V. Breeden and F. R. Tubbs. February 16th.
4,650. "Electrically-heated incubators." A. J. Trott and E. L. J. Weight. February 17th.
4,716. "Means for automatically actuating electric switch at predetermined time." A. C. French Brewster and F. W. Sturgess. February 17th.
4,718. "Control of electrically-propelled vehicles." C. F. Barnholdt and English Electric Co., Ltd. February 17th.
4,723. "Electrically-operated clocks." C. F. Johnston. February 17th.
4,728. "Searchlight sky sign." E. W. Lamb. February 17th.
4,734. "Apparatus for regulating amplitudes in electromagnetic clocks." M. P. Favre Bulle. February 17th.
4,755. "Visual signalling apparatus for colliery, &c., winding." R. A. Hopkinson and J. Hopkinson & Co., Ltd. February 17th.
4,760. "Amplifier connections for wireless telegraphy." J. Engl and J. Massolle and H. Vogt. February 17th. (Germany, February 18th, 1921.)
4,777. "Electric switches adaptors." S. W. Amphlet. February 18th.
4,791. "Device for short circuiting flow of electricity to sparking plugs with brush for cleaning such plugs, &c." G. W. Humphry. February 18th.
4,794. "Combined sparking plug and compression tap." C. J. Harris. February 18th.
4,797. "Electrical wall plugs." C. Oliver. February 18th.
4,816. "Sparking plugs." W. Danby and F. W. Dixon. February 18th.
4,824. "Electric measuring instruments." G. F. Shotter. February 18th.
4,834. "Devices for indicating time of receipt of telegraph forms for dispatch." H. P. Allin and O. Bruster. February 18th.
4,835. "Electrolysing fused salts of metals and recovering metals and acid radicles, &c." E. A. Ashcroft. February 18th.
4,923. "Apparatus for reception of signals in wireless, &c., telegraphy and telephony." J. B. Bolitho. February 20th.
4,925. "Electrical control of trains." A. R. Angus. February 20th.
4,937. "Obtaining characteristic curve of thermionic valve." G. R. Judge. February 20th.
4,938. "Loud-sounding telephones." G. R. Judge. February 20th.
4,943. "Means for regulating speed and voltage of dynamo-electric machines having permanent field magnets." British Thomson-Houston Co., Ltd., and A. P. Young. February 20th.
4,944. "Electro-magnets." British Thomson-Houston Co., Ltd. (General Electric Co.). February 20th.
4,946. "Means for generation of electricity." A. Hewer and A. A. Sharples. February 20th.
4,959. "Time-lag electric switch." R. S. Allen. February 20th.
4,961. "Magnetos." F. L. Hollister. February 20th.
4,963. "Universal electric current tapping connector." R. L. Chasselon. February 20th.
4,982. "Printing telegraphs." Soc. Francaise Radio-Electrique. February 20th. (France, March 29th, 1921.)
4,983. "Means for securing electric lamps in holders." F. C. Norton and Pulsometer Engineering Co., Ltd. February 20th.
4,992. "Tramway trolley-head." A. Challinor. February 21st.
5,013. "Tramway rails, &c." G. H. Walker. February 21st.
5,017. "Head-lights for motor-cars, &c." Calthorpe Motor Co. (1912), Ltd., and J. P. Hillouse. February 21st.
5,048. "Jigs for assembling and electrically-welding parts of automobile bodies, &c." E. G. Budd Manufacturing Co. February 21st. (United States, March 15th, 1921.)
5,051. "Railway signalling systems." Automatic Telephone Manufacturing Co., Ltd. February 21st.
5,060. "Insulators for supporting electric conductors." R. J. Kaula and A. H. Railing. February 21st.
5,069. "Synchronous dynamo-electric machine." British Thomson-Houston Co., Ltd. (General Electric Co.). February 21st.
5,070. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). February 21st.
5,073. "Electric automatic regulators." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. February 21st.
5,085. "Electrically-controlled direction-indicators for vehicles." F. H. Watts. February 21st.
5,091. "Wireless telegraph receiving systems." H. J. Round. February 21st.
5,093. "Magnetic blow-out devices for electric controlling apparatus." J. Anderson and G. Ellison. February 21st.
5,096. "Thermionic tubes, &c." J. H. Whittaker-Swinton. February 21st.
5,115. "Electric motors." M. W. Woods. February 21st.
5,157. "Incandescent safety lamps for mines." L. F. E. Ferrette. February 22nd. (France, February 23rd, 1921.)
5,170. "Electrical instruments, &c." W. K. Barker, S. G. Jones, and C. P. Ratcliffe. February 22nd.
5,184. "Magnetic clutches." J. W. Hall. February 22nd.
5,193. "Bonding-device for metal-covered electric wires." J. B. Belcher. February 22nd.
5,301. "Production of intermittent electrical conditions." H. St. G. Anson. February 22nd.
5,207. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). February 22nd.
5,209. "Transmission of messages through cables having a high electrostatic capacity." C. J. Coleman. February 22nd.
5,236. "Electric switchgear." Metropolitan-Vickers Electrical Co., Ltd. February 22nd. (United States, June 30th, 1921.)
5,251. "Device for tuning high-frequency electric oscillating circuits for wireless telegraphy, &c." K. E. Edgeworth. February 23rd.
5,253. "Electric transmission systems." A. M. Taylor. February 23rd.
5,294. "Sparking-plug cut-out." G. Wright. February 23rd.
5,309. "Dynamo-electric machines." R. D. Archibald. February 23rd.
5,315. "Electric arc welding." A. E. McCarthy, H. Martin, and L. J. Steele. February 23rd.
5,321. "Apparatus for production of high-voltage currents, applicable to thermionic valves, &c." A. W. Sharman. February 23rd.
5,337. "Motor-car current-distributors." H. R. Bellinger. February 23rd.
5,351. "Electrically-heated tools." British Thomson-Houston Co., Ltd. (General Electric Co.). February 23rd.
5,369. "Electric indicators for doors." W. R. James and A. L. Nickerson. February 23rd.
5,373. "Apparatus for testing electrical spark-producing appliances under pressure." L. Walker. February 23rd.
5,376. "Electric heating devices." E. Schattner. February 23rd.
5,378. "Selectively transferring electrical oscillatory energy." H. G. C. Fairweather (W. Dubilier). February 23rd.
5,379. "Generation and modulation of electrical oscillations." Radio Communication Co., Ltd., and J. Scott-Taggart. February 23rd.
5,380. "Radio frequency signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. February 23rd.
5,392. "Trackless trolley vehicles." G. N. Cadbury and A. W. Maley. February 23rd.
5,398. "Arrangement for recovery of energy in electrical railway systems." E. Santuari. February 23rd. (Germany, October 12th, 1920.)
5,411. "Alternating-current machines." H. Frei. February 23rd. (Switzerland, February 23rd, 1921.)
5,412. "Rotors for centrifugal compressors." Akt. Ges. Brown, Boveri et Cie. February 23rd. (Switzerland, May 14th, 1921.)
5,415. "Coupling of inductance coils for wireless apparatus." J. H. Reeves. February 23rd.
5,434. "Automatic circuit-breakers." J. F. Sutton. February 24th.
5,442. "Head-lamps for motor-vehicles." W. W. Lewis. February 24th.
5,472. "Electric transmitter microphones." E. D. Young. February 24th.
5,489. "Automatic commutators or switches." M. Y. L. Dufour. February 24th.
5,498. "Electric contacting-device." J. R. Quain. February 24th.
5,509. "Electric soldering-irons." J. F. Cesuille. February 24th. (France, June 15th, 1921.)
5,523. "Electrically-operated mining plant." Metropolitan-Vickers Electrical Co., Ltd., J. F. Perry, and A. Stubbs. February 24th.
5,541. "Tubes and leads for high electric tensions." Meirowsky & Co., Akt. Ges. February 24th. (Germany, March 19th, 1921.)
5,545. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). February 24th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

20,919. "Paper-insulated wire, especially army cable." V. Planer. July 24th, 1917. (149,005.)
25,357. "Automatically reclosing electric circuit-breakers." E. C. Raney. September 2nd, 1920. (174,971.)
26,244. "Syntonisation of circuits used in wireless signalling." R. C. Galletti. September 13th, 1920. (174,975.)
27,490. "Miners' electric lamps." Thor Electric Safety Lamp Co., Ltd., and J. W. Jones. September 27th, 1920. (174,976.)
28,101. "Thermionic or vacuum tubes or the like." A. G. T. Cusins and J. H. Whittaker-Swinton. October 4th, 1920. (174,980.)
28,250. "Electric accumulators." Soc. de l'Accumulator Tudor. November 5th, 1919. (153,570.)
28,672. "Molds for battery jars and similar hollow articles." India-Rubber Co. December 18th, 1919. (155,566.)
29,185. "Process of and apparatus for the electrical precipitation of suspended particles from gaseous media." Dr. A. L. Mond (International Precipitation Co. Inc.). October 15th, 1920. (174,995.)
30,265. "Electrode holders for electric arc welding and the like operations." W. H. Flood, D. T. Smout, A. C. Cutting and Welding Co., Ltd. October 26th, 1920. (174,997.)
30,307. "High-frequency interrupters." Ges. fur Drahtlose Telegraphie and Dr. A. Hanni. November 7th, 1919. (153,576.)
30,826. "Amplifier connecting apparatus for telephonic installations." Siemens & Halske Akt. Ges. October 31st, 1919. (153,301.)
31,223. "Incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). November 4th, 1920. (175,025.)
31,340. "Electric luminous devices." British Thomson-Houston Co., Ltd. (General Electric Co.). November 5th, 1920. (175,032.)
31,372. "Electrically-heated vulcanising apparatus." W. H. Welch and Harvey, Frost & Co., Ltd. November 5th, 1920. (175,036.)
31,529. "Electric indicating and measuring instruments." British Thomson-Houston Co., Ltd., and R. C. Clinker. November 8th, 1920. (175,052.)
31,556. "Device for airtight-jointing metal vapour rectifiers and like vacuum vessels." Gleichrichter Akt. Ges. November 7th, 1919. (153,585.)
31,711. "Electrical igniters." C. Payne and J. Wyld. November 9th, 1920. (175,060.)
31,891. "Miners' electric safety lamps." J. Davis & Son (Derby), Ltd., and G. Dearle. November 11th, 1920. (175,074.)
32,281. "Electric switches and the manufacture thereof." J. A. Crabtree. November 16th, 1920. (175,081.)
32,288. "Electric relays or like electro-magnetic apparatus." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. November 16th, 1920. (175,083.)
32,348. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). November 16th, 1920. (175,084.)
32,438. "Earthing-clips for electric conductors." E. Swainson. November 16th, 1920. (175,085.)
32,451. "Method of and apparatus for the control of electric supply plant." H. J. Read and W. J. Bransom. November 17th, 1920. (175,088.)
32,500. "Manufacture of electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 21st, 1919. (154,190.)
32,820. "Holders for electric cable lamps." J. W. Elliott and Edison Swan Electric Co., Ltd. November 20th, 1920. (175,098.)
33,099. "Connecting fittings for electric lights and the like." F. J. Tregoning. November 24th, 1920. (175,103.)
33,117. "Sparking plug." R. B. Elliott. November 24th, 1920. (175,104.)
35,915. "Locking-ring for incandescent electric lamps." W. Methven. December 22nd, 1920. (175,158.)
36,127. "Diaphragm mountings for telephones or other acoustical devices." W Stott and Telephone Manufacturing Co. (1920), Ltd. December 23rd, 1920. (175,160.)
36,321. "Measured telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gillings, and R. Mercer. December 29th, 1920. (175,163.)
36,528. "Electrical furnaces." A. Eimer. July 18th, 1914. (156,133.)

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3,683. "Magneto-ignition apparatus for internal-combustion engines." Scintilla. February 4th, 1920. (158,834.)
4,619. "Electrical circuit interrupters." Metropolitan-Vickers Electrical Co., Ltd. April 23rd, 1920. (162,267.)
12,370. "Electro-magnetic relays or like devices." Automatic Telephone Manufacturing Co., Ltd. May 6th, 1920. (162,673.)
27,533. "Starting devices for three-phase short-circuited motors." Bergmann Elektricitats-Werke Akt. Ges. October 25th, 1920. (170,579.)
29,490. "Miners' or other electric lamps." E. A. Hailwood. August 25th, 1920. (Divided application on 174,664.) (175,230.)